A revision of the New Guinea weevil genus *Apirocalus* Pascoe (Coleoptera: Curculionidae)

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Contents

Synopsis

Thirty-four species and nine subspecies are described and included in a key. Twenty-nine of the species and all the subspecies are new. The species are arranged in eleven groups, two of which are placed in a new subgenus. The types of the six previously described species have been examined and one lectotype designated; one of the six is promoted from varietal status and another is transferred to a new genus. To this new genus is added a second species from a genus the (homonymous) name of which is replaced. The biology, distribution and economic importance of the species are discussed. Variation in the length of the flagellum is introduced as a character for separating closely related species. Examples of structural variation in response to factors related to altitude are noted.

Introduction

The need for the present revision became apparent when it was discovered that the series of *Apirocalus cornutus* in the collection of the Department of Agriculture, Stock and Fisheries, Port Moresby, included a number of other species of this genus (and some of other genera), several of which were undescribed. The incentive to make the revision was provided by Dr J. J. H. Szent-Ivany, former Senior Entomologist, DAPM, who wished to include this material in his *Economic insects of Papua New Guinea* (in press).

Depositories

AMNH American Museum of Natural History, New York.
ANIC [Australian National Insect Collection,] Division of Entomology, CSIRO, Canberra.
BMNH British Museum (Natural History), London.

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BPBM	Bernice P. Bishop Museum, Honolulu.
CAS	California Academy of Science, San Francisco.
CWO'B	Dr C. W. O'Brien, Tallahassee, Florida.
DAPM	Department of Agriculture, Stock and Fisheries, Konedobu, Port Moresby.
DFB	Department of Forests, Bulolo, Papua, New Guinea.
FMNH	Field Museum of Natural History, Chicago.
IP	Institut für Pflanzenschutzforschung, Eberswalde (formerly Deutsches Entomologisches Institut).
MCZ	Museum of Comparative Zoology, Harvard University, Boston.
MGF	Museum G. Frey, Tutzing, Munich.
MNHN	Muséum national d'Histoire naturelle, Paris.
NMNH	National Museum of Natural History, Washington (formerly United States National Museum).
NMV	National Museum of Victoria, Melbourne.
RNH	Rijksmuseum van Natuurlijke Historie, Leiden.
RWH	Dr R. W. Hornabrook, Wellington.
SAM	South Australian Museum, Adelaide.
SMT	Staatliches Museum für Tierkunde, Dresden.
TM	Természettudományi Múzeum, Budapest.

Biology and economic importance

Species of *Apirocalus* have been found in primary and secondary rainforest, grassland, native gardens and plantations of all kinds. They appear, however, to avoid marshy areas (Maps 1, 8). Some of the smaller species have been found on the ground, in leaf litter and in rotting vegetation. Adults have been found on, and often attacking, a very wide range of flowering plants including herbs, shrubs and trees (Szent-Ivany, 1958 : 435). Their main economic importance arises from their habit of attacking the tender terminal shoots of shrub crops, such as tea and coffee and those of tree seedlings, such as cacao and rubber. Other crops attacked include cotton, rice, maize, banana, taro, soya bean, cowpea, Brussels sprouts and ripe strawberries (see Plant index, p. 279). They have also been found on hoop and Klinki pines (Coniferae, Araucariaceae). Gray & Wylie (1974 : 74) describe damage caused to hoop pine seedlings by caged adults of *A. ebrius*. They have not been found on any cryptogamic plants, although fern sporangia have been observed attached to several specimens. Flowers are sometimes eaten; *A. ebrius* was found attacking banana flowers at Madang (Szent-Ivany & Barrett, 1956 : 41) and pollen was found in the hindgut of a specimen of *A. cornutus tenuiscapus* from Mt St Mary. This consisted mainly of large spiny grains of a malvaceous plant (*Hibiscus*, *Abelmoschus* or possibly *Thespesia*) with some smaller grains of Amaranthaceae, probably *Gomphrena*.

The immature stages are unknown but, by analogy with other otiorhynchines, the larvae are probably root-feeders. Gravid females have been found to contain 20–30 smooth, oval or oblong whitish eggs.

Common names: 'coffee shoot weevil' (Simmonds, 1960); 'grey weevils' (Simon Thomas & Verloop, 1962).

Parasites and predators

Diptera

A remarkable tachinid (?) larva was found in a female of *A. ebrius* from Budemu, Finisterre Range. The posterior spiracles are enormously enlarged, reminiscent of those of a tsetse fly larva but more dorsally situated. This larva bears no resemblance to any known tachinid parasites of other otiorhynchine weevils and none has yet been reared from the Celeuthetini. A first instar tachiniform larva was found in a male of *A. sedlaceki* from Nami Creek (near Wau) and a second instar larva came from a male of *A. fallax* from Perumeva (near Tapini). All three larvae have been described by K. G. V. Smith in a manuscript that will go to press when this revision has been published.

Hymenoptera

A small larva, possibly belonging to the Proctotrupidae, was found in a male of *A. mus* from the Singuawa River (near Lae). A larger larva was found in a female of *A. stellifer* from Okasa (near Okapa) and three large larvae almost filled the abdomen of a male *A. olivaceus* from Mt Giluwe.

Strepsiptera

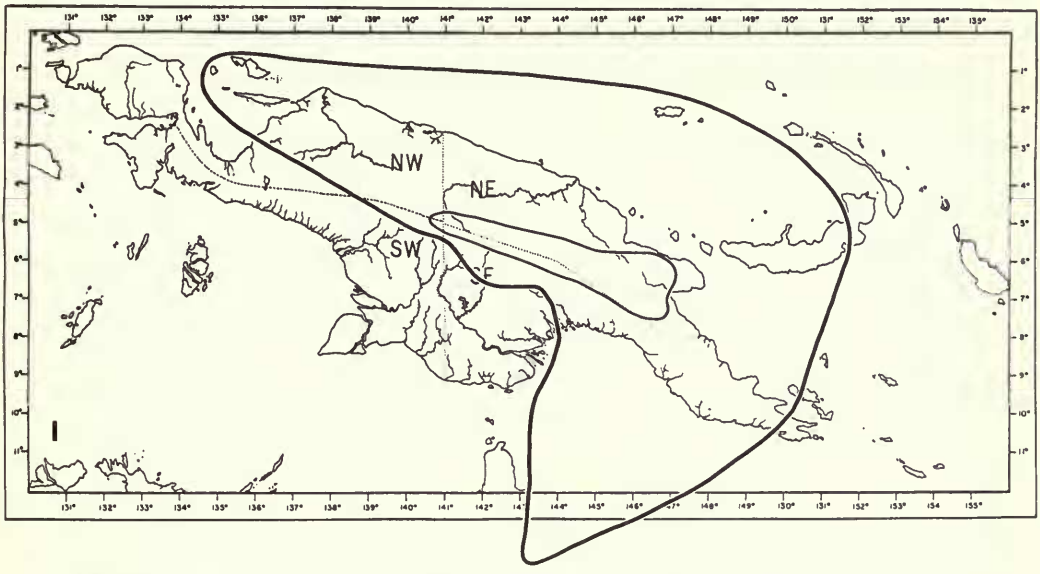
A specimen, probably of *A. e. ebrius* (recorded as *cornutus*) from Aiyura has been reported with 'a possible strepsipteron' protruding from the abdomen (Simmonds, 1960 : 54).

Acarina

Larvae of erythraeid mites of the genus *Leptus* (=*Achorolophus*) have been found attached to specimens of *A. a. avus*, *A. atrigenua*, *A. hydrographicus* and *A. e. ebrius*, among others.

Aves

The hind-bodies of two male specimens of *A.* sp., ? *sedlaceki* were recovered from the stomach of a small honeyeater, *Myzomela rosenbergi* Schlegel (Aves, Meliphagidae), at Wau (specimens in MCZ).



Map 1 Range of *Apirocalus* (outer loop); range of subgenus *Molobrium* (inner loop).

Distribution

Map 1 shows the established range of the genus. The two major lowland species (*cornutus* and *ebrius*) have populations on certain off-shore islands, New Britain, Manus I. and Cape York. These differ slightly from their mainland counterparts and thus appear to be of long standing. Records of *A. ebrius* from further afield (Solomons, Philippines) must, if genuine, be the result of recent introductions. It is an interesting fact that the two largest species both occur (at about 1500 m) on off-shore islands (*A. hornabrooki* on Karkar I. and *A. ater* on Goodenough I.).

Although the members of each species-group are usually strictly allopatric, those of two, or even three different groups may occur together, e.g. *A. cornutus tenuiscapus*, *A. canus* and *A. fallax* in the upper part of the Alabule river valley (Central District, Goilala Subdistrict); *A. ebrius wagneri*, *A. avus finisterrae* and *A. gracilis* in the hills above Saidor (Finisterre Range, northern Morobe District).

The species of *Apirocalus* show marked differences in their vertical distribution. Most belong in Group III of Szent-Ivany's classification (1200*–2400 m) (Szent-Ivany, 1965 : 20) though the ranges of several descend to 1000 m and some to 700 m while that of *A. avus intermedius* rises to 2700 m. *A. bacchusi* and *A. strigifrons* are known only from 2700 m and 2800 m respectively. *A. hydrographicus* and *A. cornutus virescens* have distinctly lower ranges at 300–1300 m and 400–1700 m respectively, while *A. olivaceus* has a higher one at 2200–3900 m. *A. cornutus tenuiscapus* seems anomalous with a range of 600–2550 m but consists of two local forms which occur at different altitudes. Of the lowland species, *A. mus* and *A. c. cornutus* belong in Group I (0–900 m) while *A. e. ebrius* appears to belong in Group II (0–2200 m) though this subspecies also consists of numerous ± distinct local forms which occur at various altitudes.

Descriptions of genera

APIROCALUS Pascoe

Apirocalus Pascoe, 1881 : 590. Type-species: *Apirocalus cornutus* Pascoe, by monotypy.

Celeuthetine Curculionidae (*sensu* Marshall, 1956 : 5) with dorsal surface of rostrum as broad at base as between antennal insertions, or broader, smoothly and increasingly declivous towards apex, the sloping area strongly and irregularly punctured and devoid of scales; scrobes open posteriorly; base of rostrum level with frons; rostro-frontal furrow angulate, usually very deep (except in mid-line); antennal funicle segment 1 ≏ or < 2 and hind tarsi with segment 2 = or < 3; head not constricted behind eyes; scutellum obsolete; metepisternal suture incomplete posteriorly; femora and tibiae unarmed.

All the species of *Apirocalus* have a single pair of dorsal elytral tubercles or processes, sometimes accompanied by much smaller accessory granules or swellings. Some unrelated genera have very similar elytral processes but in these the rostrum is abruptly declivous towards the apex; to distinguish *Apirocalus* it is therefore essential to check the rostrum. In *Apirocalus* there are four principal setae on the mentum, a larger outer pair and a smaller inner pair. These are accompanied by 0–4 smaller setae which are often irregularly arranged. Similarly, each mandible has 5 or 6 large setae and 2–4 smaller ones.

A remarkable feature of *Apirocalus* is the great variation shown by the antennal scape (Figs 4–15); several species-groups can be recognized from this structure alone. The 10 elytral striae may be grossly distorted or even interrupted by the elytral processes; stria 10 is complete but greatly attenuated behind the level of the hind coxae. The trochanters lack the single large seta which so many genera have; both coxae and trochanters are normally devoid of scales but the fore coxae bear scales in some lowland species. The arms of the mesosternum and the mesepisterna may, or may not, bear scales.

Both sexes almost certainly occur in all the species, though three are presently known from females only. The ♂ : ♀ ratio usually approaches 1 : 1 but in *A. avus intermedius* it is 1 : 2 (in 35 ex.) and in *A. stellifer* it is 3·2 : 1 (in 25 ex.). The elytral processes of the male are frequently longer than those of the female and often differently shaped. In *A. acutus* the fore femora and antennal funicle are also dimorphic. In the *cornutus*-group, dimorphism occurs affecting the rims of the rostral pterygia. In the males, these are microsculptured (as they are in both sexes throughout the rest of the genus) but in the females of this group they are smooth and highly polished (Fig. 244). These females are also usually distinguished by having a number of large erect setae at the postero-ventral margin of the prothorax (Fig. 243).

The genitalia are shown in Figs 74–78. The genital tract is very elongate in both sexes. The ovipositor is capable of considerable extrusion (up to ×0·7 body-length). A flagellum is normally present in the male; its length varies greatly between the species and this variation is reflected in the length of the spermathecal duct of the female. The latter opens proximally on a spout in a subspherical chamber at the distal end of the bursa copulatrix (Fig. 82). The oviduct opens into the bursa immediately below this chamber. The ovipositor valves and their setae (Fig. 83) are remarkably constant throughout the genus but the proportions of the styli vary.

* The lower limit, 4700 ft, has been changed to 4000 ft in a copy of this paper received from the author.

Apirocalus is one of seven genera separated by Marshall (1956 : 9) because the apex of the rostrum is not abruptly declivous dorsally. Of these, four (*Acoptorrhynchus* Heller, *Oedirrhynchus* Marshall, *Idorhynchus* Faust and *Pachyrhynchidius* Faust) are monotypic and of uncertain affinities. Despite marked superficial differences, the remaining three form a close-knit group; they may be separated by the following provisional key.

1 Antennal scape shorter than pronotum and segment 2 of hind tarsus shorter than 3 but if, in either case, equal in length, then pronotum strongly granulate 2
– Antennal scape longer than pronotum and segment 2 of hind tarsus longer than 3 but if, in either case, equal in length, then pronotum without granules.
Scales pale green . . . . . ***HELLERRHINUS***
2 Pronotum smooth, with a broad median sulcus. Dorsum bare or with a few very thinly scattered scales. Sides of prothorax with very fine and sparse punctures. Antennal funicle segment 1 usually slightly longer than 2; club not, or very slightly, wider than funicle ***KOKODANUS***
– Pronotum rough, uneven or granulate, sometimes depressed but without a median sulcus. Dorsum with numerous, often very dense, scales. Sides of prothorax with large dense punctures or rugae (often concealed by scales). Antennal funicle segment 1 usually shorter than 2; club distinctly wider than funicle . . . . . ***APIROCALUS***

The *nivosus*- and *olivaceus*-groups of *Apirocalus* show some affinity with *Hellerrhinus* while *H. bispinosus* Marshall links *Hellerrhinus* and *Kokodanus*; an undescribed species of *Kokodanus* provides a reciprocal link with *Hellerrhinus*.

Methods

Since the genitalia of both sexes extend into the thorax, it was necessary to remove the entire abdomen (having first softened the specimen in warm water). The suture between the metasternum and venter is long, straight and partly fused, so that considerable force was required to open it (even with a scalpel). Once free, the venter was pulled carefully backwards until the gut and tergites parted, leaving the genitalia intact. The whole abdomen was then cleared with potash before further dissection. After dissection, the transparent parts of the genitalia were stained with chlorazol black (in very dilute solution). Any drawings of delicate or enclosed structures were made at this stage before transfer to glycerine for storage. Most of the preparations were placed in glass microvials fitted with corks but some plastic vials were also used.

Measurements were normally made directly, using an eye-piece scale but the flagellum and spermathecal duct were first sketched, using a camera lucida, and the drawing then measured with dividers set to the equivalent of 0·1 mm.

The dissected specimens were mounted on an upward-curving card point, inserted from behind into the thorax with the venter, inverted, on a separate point below. This method obviates the difficulties inherent in attempting to pin, or re-pin, a specimen from which the abdomen has been removed and at the same time allows the entire external anatomy of the specimen to be examined.

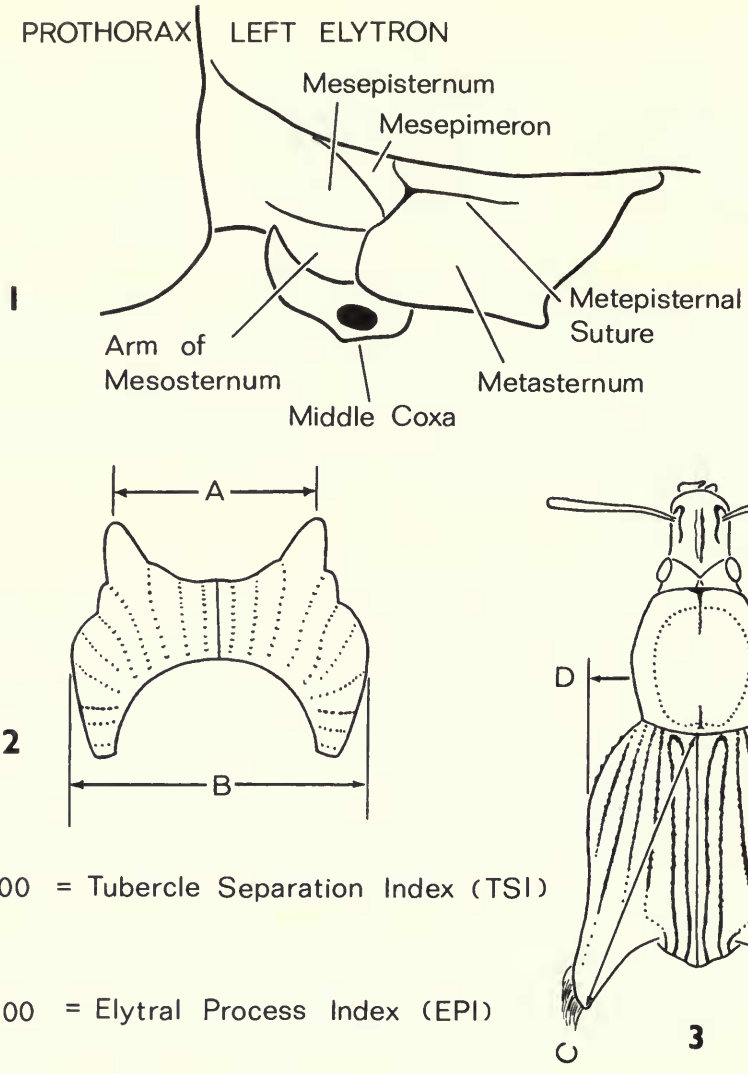
Identification

In preparing the key, I have used external characters as far as possible. Where it has proved necessary to add internal characters, these are always given after the externals. Sexual dimorphism and other forms of variation are allowed for by bringing out the same species at several places. Hence, if the characters of a specimen seem ambiguous at a certain point in the key, it is likely that either alternative will lead to a correct exit. Since the ranges of most species are very limited, reference to the appropriate description will usually indicate immediately whether or not the determination is correct.

The dearth of strong external characters has prevented me from making a workable key to the species-groups; these are shown in the check-list on p. 206 and their characters are given on the pages there indicated.

The terminology used is as in my earlier paper (Thompson, 1968 : 366) except that I have frequently been obliged to refer to the claw-segment of the tarsus as 'segment 5'; it needs to be

remembered that segment 4 is here concealed between the lobes of segment 3, as in most Curculionidae.



Figs 1–3 1, Thorax of *Apirocalus* in side view (drawn from a female of *A. paradoxus*). 2, *Apirocalus* (*Molobrium*) *gracilis*, elytra of male in antero-dorsal view. 3, *Apirocalus* (*A.*) *olivaceus*, male.

As it is impossible to make accurate measurements of the elytral processes, I have used instead the two indices shown in Figs 2 and 3. It is important to note that the EPI does not necessarily reflect the length of the processes; *A. nivosus* and *A. atrigenua* have similar EPIs but the latter has much longer processes than the former (but shorter elytra). Obviously, steeply rising processes contribute little to the longitudinal measurement. Various dimensions (especially of the male genitalia) are compared, not only to each other but also to the length of the pronotum. The latter is one of the few dimensions capable of accurate measurement and is thus a better standard of size than the overall length.

Key to the subgenera, species and subspecies

1 Elytra, at top of declivity, with a pair of setiferous tubercles or straight tapering subisodiametric processes, centred on interstriae 3 and/or 4, rising steeply and not, or weakly, diverging (Fig. 2), lying entirely within elytral outline (viewed from above) or with only their apices projecting beyond it. Length < 7 mm. (Subgenus *Molobrium* subgen. n.) 2

– Elytra, at top of declivity, with a pair of angulate or blade-like (Fig. 3) or curved processes, centred on interstriae 5 and/or 6, usually subhorizontal or weakly rising (very short and obtuse in some cases); if steeply rising or subisodiametric, then either strongly diverging or body-length > 7 mm and processes projecting well beyond elytral outline. (Subgenus *Apirocalus* Pascoe) 8

2 (1) Mesepisterna with very small ill-defined punctures and no scales. Median lobe of aedeagus > × 3 as long as broad 3

– Mesepisterna with large deep well defined punctures and (usually) some scales. Median lobe of aedeagus < × 3 as long as broad 4

3 (2) Prothorax as long as or slightly longer than broad; sides ± evenly rounded. Each elytral process simple (♂) or with a much smaller accessory tubercle close against its outer side (♀). Male with disc of metasternum flat and disc of ventrite 1 without any carinae. Scales on body greenish . . . . . ***gracilis*** sp. n. (p. 207)

– Prothorax slightly broader than long; sides strongly rounded in middle, tapering strongly and ± evenly to both base and apex. Each elytral process (in ♂) with two accessory tubercles (Fig. 31) (♀ unknown). Male with disc of metasternum convex and ventrite 1 with a pair of longitudinal carinae, separated by a distance about equal to length of ventrite 4 . . . . . ***stibicki*** sp. n. (p. 209)

4 (2) Elytral tubercles without any smaller accessory tubercles; adjacent interstriae on outer side of tubercles not strongly convex. Posterior half of mesepisterna covered with scales which are at least as large as those on metasternum and elytra. Upperside of elytra (except disc) covered with erect, almost straight setae, of equal length-range throughout, the longest at least as long as greatest diameter of antennal scape (Fig. 30). Median lobe of aedeagus × 2·5 as long as broad and with a pair of admedian dorsal carinae which project apicad over edge of phallotreme (Fig. 92) . . . . ***io*** sp. n. (p. 209)

– Elytral tubercles either with a much smaller accessory tubercle on outer side or the two adjacent interstriae convex or costate but, if simple, then either mesepisterna with only a few small scales or elytral setae semi-erect and shorter than greatest diameter of scape. Median lobe of aedeagus < × 2·4 as long as broad; dorsal carinae, if present, not projecting apicad 5

5 (4) Sections of elytral interstriae 5 and 6 adjacent to tubercles usually convex or costate (best seen in antero-dorsal view) but not forming discrete tubercles. Scales on mesepisterna numerous (15–50) and as large, or almost as large, as those on elytra. Ventrite 1 of ♂ without, or with a narrow median sulcus (< half width of intercoxal process). Median lobe of aedeagus with no trace of dorsal carinae 6

– Sections of elytral interstriae 5 and 6 adjacent to tubercles not, or weakly convex; interstria 5 with or without a small accessory tubercle. Scales on mesepisterna few (< 15) and smaller than those on elytra. Ventrite 1 of ♂ with wide median sulcus (> half width of intercoxal process). Median lobe of aedeagus with at least some traces of (smooth) dorsal carinae 7

6 (5) Smaller (length < 5·9 mm). Median lobe of aedeagus < × 2·2 as long as broad (Figs 107–110) . . . . . ***terrestris terrestris*** subsp. n. (p. 213)

Larger (length > 5·8 mm). Median lobe of aedeagus × 2·3 as long as broad (Figs 111, 112) ***terrestris dissidens*** subsp. n. (p. 213)

7 (5) Base of elytral tubercles extending over interstriae 2–4 with a small accessory tubercle in interstria 5, usually clearly marked off from main tubercle by a cleft in line of stria 5. Sulcus on ventrite 1 of ♂ delimited by longitudinal carinae. Setae near sides of elytra often twice as long as those on femora. Median lobe of aedeagus with well developed dorsal carinae (Figs 94–96); flagellum present . . . . . ***celatus*** sp. n. (p. 210)

– Base of elytral tubercles extending over interstriae 2–5 with, sometimes, a very small tubercle arising from outer side of each main tubercle (sometimes present on only one of the two main tubercles). Sulcus on ventrite 1 of ♂ ill-defined. Setae near sides of elytra usually less than twice as long as those on femora. Median lobe of aedeagus with only traces of dorsal carinae (Figs 97–99); flagellum absent . ***occultator*** sp. n. (p. 211)

8 (1) Elytral processes subisodiametric, terete, tapering, parallel or only weakly diverging, projecting beyond elytral outline for about half their length (Fig. 234).
Length > 7 mm; scales, in part, bright pale green . . . . . ***nivosus*** sp. n. (p. 226)

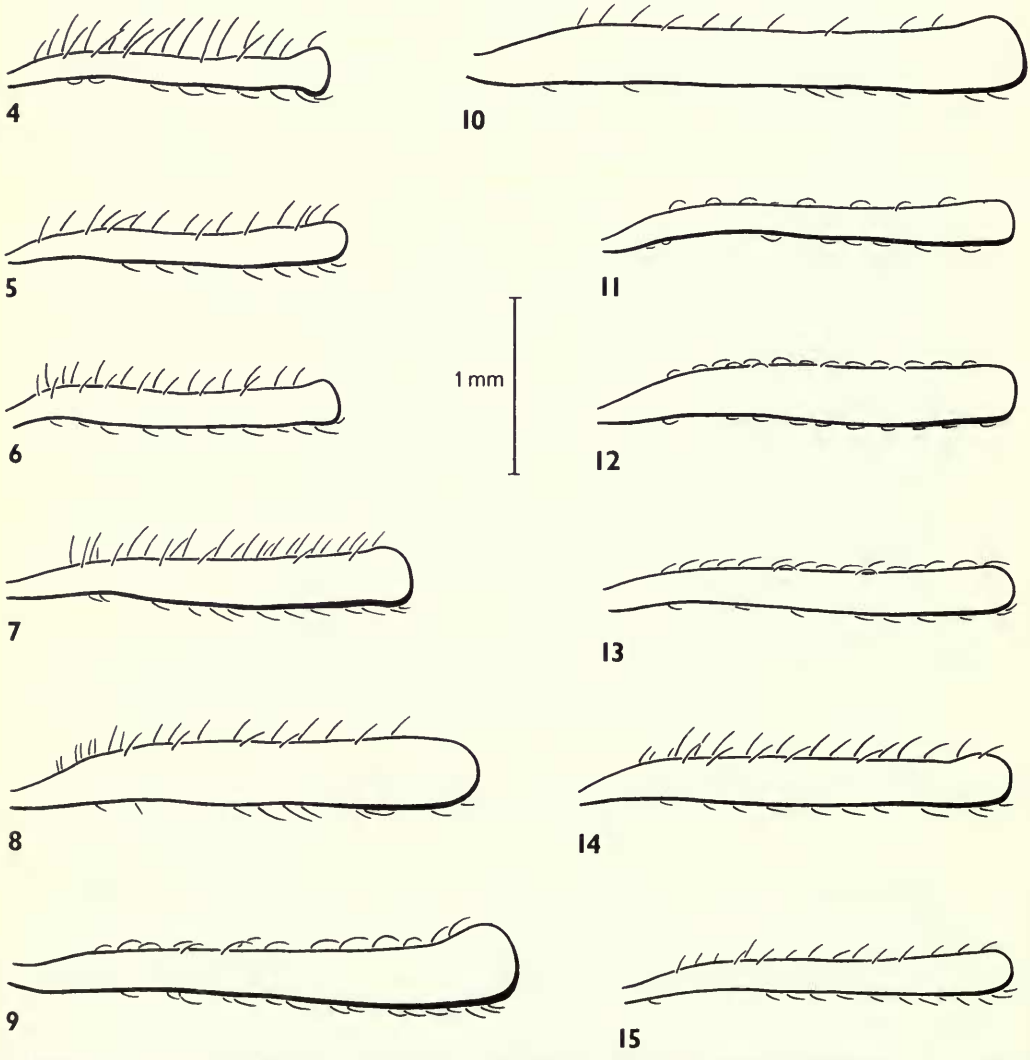
– Elytral processes distinctly diverging or represented by obtuse angulations . . . 9

9 (8) Antennal scape flattened and without any trace of an apical expansion or pre-apical constriction (in dorsal view) (Figs 8, 12); widest point usually within middle two-thirds of length but if at apex (Fig. 13), then setae on leading edge all pale and ± recumbent and disc of pronotum not depressed 45

– Antennal scape slender and terete, or claviform, or flattened and with an apical expansion, often delimited by a pre-apical constriction. 10

10 (9) Antennal scape slender, widening smoothly, evenly and very gradually from near base to apex without any abrupt apical expansion or pre-apical constriction (Figs 11, 15) . 11

– Antennal scape widening more strongly near apex or widening unevenly, with a ± distinct pre-apical constriction or parallel-sided, with a very weak apical expansion (Figs 4, 6, 7, 9, 10, 14) 20



Figs 4–15 Antennal scapes of *Apirocalus* (*A.*) species. 4, *fallax*; 5, *asper*; 6, *sedlaceki*; 7, *nivosus*; 8, *bacchusi*; 9, *hydrographicus*; 10, *ater*; 11, *vexillarius*; 12, *c. cornutus*; 13, *cornutus tenuiscapus*; 14, *ebrius wagneri* (example with expanded apex); 15, *olivaceus*.

11 (10) Granules on disc of pronotum well-defined and larger than those on elytra (near base), their diameter $\times 3$–4 that of surrounding scales. Setae on antennal scape soft, recumbent and inconspicuous, those on fore edge similar to those on hind edge . . 12

– Granules on disc of pronotum ill-defined, often confused, usually smaller than those on elytra and $\times 1$–3 diameter of surrounding scales. Setae on antennal scape stiff, those on fore edge usually larger and more nearly erect than those on hind edge . . . 13

12 (11) Body with pale lateral stripe. Eyes moderately convex, as in *A. cornutus* (Fig. 16) ***vexillarius*** Marshall (p. 232)

– Body without lateral stripe. Eyes smaller and more strongly convex, as in *A. ebrius* (Fig. 17) . . . . . ***inornatus*** sp. n. (p. 233)

13 (11) Longest diameter of eyes (faceted area) *c.* $\times 0{\cdot}8$ shortest distance between them. Elytral processes very short and each with a prominent swelling at base on inner side ***asper*** Marshall (p. 216)

– Longest diameter of eyes $< \times 0{\cdot}6$ shortest distance between them. Elytral processes without any swelling at base 14

14 (13) Spread of elytral processes exceeding greatest width of elytra proper (males) . . . 15

– Spread of elytral processes about equal to greatest width of elytra proper (females) . 18

15 (14) Elytral processes slender, subisodiametric, ± terete. Scales on elytra in great part bright rust-brown with a prominent whitish patch near base and another on declivity below processes (Fig. 5) . . . . . ***stellifer*** sp. n. ♂ (p. 250)

– Elytral processes usually broader and ± flattened but if slender, then elytra without pale patch near base 16

16 (15) Elytral processes straight, stout and steeply rising (in profile view). Apical region of aedeagus elongate, tip usually thickened (Figs 218, 219, 222–225) 17

– Elytral processes more elongate and usually less steeply rising but, if very steep, then curved. Apical region of aedeagus broad and thin (Figs 226–232) ***olivaceus*** sp. n. ♂ (p. 251)

17 (16) Elytral processes very short, bluntly angulate, almost vertical (in profile view) and situated mid-way between base and apex of elytra (Fig. 238). Scales on elytra imbricate, concealing integument . . . . . ***anatinus*** sp. n. ♂ (p. 253)

– Elytral processes longer, less strongly tapering, inclined posteriad and situated nearer to elytral apex than base. Scales on elytra usually very small, separate, not concealing integument, so that body appears dull black to unaided eye ***tenebricosus*** sp. n. ♂ (p. 253)

18 (14) Elytral processes inclined more strongly posteriad; EPI (Fig. 3) 107–123 19

– Elytral processes more steeply rising and more strongly diverging; EPI 105–107 ***tenebricosus*** sp. n. ♀ (p. 253)

19 (18) Prothorax with fringe of large erect setae along postero-ventral margin. Scales on elytra in great part bright rust-brown with a prominent whitish patch near base and another on declivity below processes . . . . . ***stellifer*** sp. n. ♀ (p. 250)

– Prothorax without such setae. Elytra without pale patches, scales commonly dull greenish, paler on declivity . . . . . ***olivaceus*** sp. n. ♀ (p. 251)

20 (10) Elytra globose, at least as strongly convex on disc as on top of declivity (in profile view) 21

– Elytra distinctly less strongly convex on disc than on top of declivity 23

21 (20) Antennal scape straight, flattened, ± parallel-sided and very feebly expanded at apex (Fig. 10). Length *c.* 12 mm . . . . . ***ater*** sp. n. (p. 231)

– Antennal scape sinuous, ± terete, widening apicad throughout and strongly expanded at apex (Fig. 9). Length $< 10{\cdot}5$ mm 22

22 (21) Setae on antennal scape curved and ± recumbent (on both edges). Elytral processes of ♂ subisodiametric and strongly tapering from base, becoming explanate in distal third and with a well defined white patch between their bases; processes of ♀ about half as long as those of ♂, not widening towards apex and seldom with a well defined white patch between their bases . . . . . ***hydrographicus*** Marshall (p. 229)

– Setae on antennal scape stiffer, semi-erect (especially on leading edge). Elytral processes of ♂ not widening distally and without any well defined white patch between their bases (entire apical region pale); processes of ♀ acuminate, no longer than broad ***orientalis*** sp. n. (p. 231)

23 (20) Disc of pronotum with a large well defined flat or weakly concave area, the granulation of which is uniform throughout and similar to that on sides of pronotum. 24

– Disc of pronotum weakly convex or, if flattened, this area is undefined and granules larger on disc than on sides 25

24 (23) Elytral processes short and broad with a well defined outer edge which in ♂ continues along sides of elytra almost to base (Fig. 241) and in ♀ is produced as a low carina which runs obliquely across each elytron. Rostrum with a distinct median carina ***acutus*** sp. n. (p. 248)

– Elytral processes more elongate and rounded on their outer aspect (Fig. 233). Rostrum without a distinct median carina . . . . . ***strigifrons*** sp. n. (p. 247)

25 (23) Elytral processes at least as long as broad, subisodiametric and steeply rising (Figs 234, 235).
Length > 7 mm 26

– Elytral processes shorter than broad or, if longer, then dorso-ventrally compressed and not, or weakly rising 27

26 (25) Elytral processes longer than broad and distinctly diverging. Disc of pronotum weakly convex anteriorly, flattened posteriorly. Knees black. . . . ***atrigenua*** sp. n. ♂ (p. 227)

– Elytral processes as long as broad, parallel (♂) or weakly diverging (♀). Disc of pronotum strongly convex in anterior half, not flattened posteriorly. Femora unicolorous ***nivosus*** sp. n. (p. 226)

27 (25) Elytral processes broader than long, cone-shaped, without any swelling on meso-dorsal aspect 28

– Elytral processes more elongate or with a swelling on meso-dorsal aspect 29

28 (27) Femora with knees black. Rims of pterygia microreticulate. Length *c.* 9 mm ***atrigenua*** sp. n. ♀ (p. 227)

– Femora unicolorous. Rims of pterygia smooth (Fig. 244). Length usually < 9 mm ***ebrius wagneri*** subsp. n. ♀ (p. 245)

29 (27) Elytral interstria 3 (or 3 + 4 + 5) ± distinctly raised for a short distance near base. Surface of elytra usually uneven and rough. Median lobe of aedeagus strongly curved or, if only moderately curved, then upper surface with a pair of sharp admedian carinae (Fig. 121).
Length < 7·5 mm 30

– Elytral interstria 3 not raised, or both 3 and 5 separately raised from near base of elytra to base of processes. Surface of elytra otherwise even, without any irregular elevations. Median lobe of aedeagus weakly curved; upper surface without sharp carinae . . 32

30 (29) Antennal scape claviform (Fig. 5); setae on leading edge, on average, shorter than greatest diameter of scape in middle of length. Internal sac of ♂ with pigmented spatulate denticles (Fig. 81) . . . . . ***asper*** Marshall (p. 216)

– Antennal scape capitate; setae on leading edge, on average, longer than greatest diameter of scape in middle of length (Fig. 4). Internal sac of ♂ without, or with pointed unpigmented denticles 31

31 (30) Elytral processes very short in both sexes, ± rectangulate in ♂, rounded (sometimes almost obsolete) in ♀ (Figs 32, 36) . . . . . ***fallax*** sp. n. (p. 214)

– Elytral processes longer and acute in ♂ (Fig. 38) (♀ unknown) . . ***insperatus*** sp. n. (p. 216)

32 (29) Prothorax of ♂ × 0·68 greatest width of elytra (excluding processes), its upper surface covered with raised round bead-like granules which occur over mid-line without interruption. Elytral processes of ♀ horizontal, directed posteriad or weakly diverging (their inner margins making an acute angle), often with an elongate swelling on inner side reaching almost to apex (Fig. 240). Average length 8·3 mm. Spermatheca with additional, blind lobe (Fig. 146).
Scales on body, in part, green . . . . . ***granulicollis*** sp. n. (p. 225)

– Prothorax of ♂ × 0·56–0·66 greatest width of elytra, its upper surface usually with fewer granules which are often divided along mid-line. Elytral processes of ♀ strongly diverging (their inner margins making an obtuse angle), without, or with a round swelling on inner side. Average length 6·6 mm. Spermatheca without additional lobe 33

33 (32) Scales on mesepisterna and arms of mesosternum (Fig. 1) similarly dense or imbricate ***ebrius wagneri*** subsp. n. ♂ (p. 245)

– Scales on mesepisterna smaller and less dense than those on arms of mesosternum or *vice versa* (never similarly dense or imbricate on both) 34

34 (33) Antennal scape with all fringing setae white. Scales on arms of mesosternum smaller and/or sparser than those on (adjacent) mesepisterna. Elytral processes fairly well developed in both sexes . . . . . ***canus*** sp. n. (p. 224)

– Antennal scape with fringing setae brown, in part at least, but if all white then

scales on arms of mesosternum larger and/or denser than those on mesepisterna (Fig. 245). Elytral processes reduced in ♀ or in both sexes (Figs 40–47, 51, 54) . . . 35

35 (34) Elytral processes elongate, truncate at apex, thickened along inner margin but without a distinct swelling (Figs 50, 52, 53).
Males 36

– Elytral processes short, angulate; if somewhat elongate, then inner margin distinctly swollen (Figs 46, 47) 39

36 (35) Elytral processes more slender (Fig. 50).
Flagellum about as long as pronotum . . . ***avus marawakanus*** subsp. n. ♂ (p. 221)

– Elytral processes broader (Fig. 52) 37

37 (36) Prothorax about as long as broad, sides more strongly rounded (Fig. 49). Flagellum > × 1·4 as long as pronotum, more strongly curved towards base (Fig. 76) . . . 38

– Prothorax, on average, × 1·08 as long as broad, sides less strongly rounded (Fig. 52). Flagellum about as long as pronotum (< × 1·3 as long) and evenly curved throughout its length . . . ***avus avus*** subsp. n. ♂ (p. 219); ***avus finisterrae*** subsp. n. ♂ (p. 221)

38 (37) Scales on arms of mesosternum dull. Flagellum < × 2 as long as pronotum
avus karimuicus subsp. n. ♂ (p. 220)

– Scales on arms of mesosternum bright (Fig. 245). Flagellum > × 2 as long as pronotum
sedlaceki sp. n. ♂ (p. 221)

39 (35) Elytral processes each with a gross, abscess-like swelling on its meso-dorsal aspect (Fig. 45). Pronotal granules, in general, few and small, often only × 1–2 diameter of surrounding scales. Flagellum *c.* × 3 as long as pronotum . . . ***suppuratus*** sp. n. (p. 223)

– Elytral processes without, or with a weaker swelling but, if almost as strong, then pronotal granules larger and more numerous. Flagellum < × 2 as long as pronotum 40

40 (39) Elytral interstriae 3 and 5 ± distinctly convex. (Elytral processes usually with a distinct swelling on meso-dorsal aspect; those of ♂ (♂ has crater-like depression on ventrite 5) no wider than elytra, those of ♀ reduced, narrower than elytra, their posterior margins in a line or making a very obtuse angle with each other (Figs 40–43))
subcostatus sp. n. (p. 217)

– Elytral interstriae 3 and 5 not convex 41

41 (40) Spread of elytral processes exceeding greatest width of elytra proper 42

– Spread of elytral processes equal to, or less than greatest width of elytra proper.
Females 43

42 (41) Hind margin of last abdominal tergite thin, strongly rounded and with fringe of projecting setae . . . . . ***avus finisterrae*** subsp. n. ♀ (p. 221)

– Hind margin of last abdominal tergite thickened, broadly truncate, without a fringe of setae . . . . . ***avus intermedius*** subsp. n. ♂ (p. 220)

43 (41) Spread of elytral processes distinctly less than greatest width of elytra proper (Fig. 51). Elytra not, or very weakly, constricted at process bases; processes cone-shaped, with little trace of edges. Setae near sides of elytra usually about twice as long as those on femora . . . . . ***avus marawakanus*** subsp. n. ♀ (p. 221)

– Spread of elytral processes equal to or only slightly less than greatest width of elytra proper. Elytra usually distinctly constricted at process bases; processes somewhat flattened, with a short but distinct outer edge towards apex. Setae near sides of elytra, on average, less than twice as long as those on femora 44

44 (43) Prothorax slightly broader than long, sides more strongly rounded (Fig. 49)
sedlaceki sp. n. ♀ (p. 221); ***avus karimuicus*** subsp. n. ♀ (p. 220)

– Prothorax as long as, or slightly longer than, broad; sides less strongly rounded (Fig. 54)
avus avus subsp. n. ♀ (p. 219); ***avus intermedius*** subsp. n. ♀ (p. 220)

45 (9) Disc of pronotum depressed and with traces of a narrow median carina (obscured by scales). Elytra shagreened.
Scales on body bright pale green . . . . . ***bacchusi*** sp. n. (p. 228)

– Disc of pronotum not depressed and never with any trace of a median carina. Elytra shiny 46

46 (45) Rostrum with rims of pterygia milled. Setae near hind margin of prothorax, below sides, much smaller than those in mid-line (around post-coxal callus), usually recumbent and very inconspicuous 47

– Rostrum with rims of pterygia smooth (Fig. 244). Setae near hind margin of prothorax, below sides, usually as large as or larger than those in mid-line, fully erect and con-

spicuous (Fig. 243) but very small in a few cases.
Females 60

47 (46) Scales on mesepisterna smaller, duller and less dense than those on adjacent part of elytra. Length rarely > 8 mm . . . . . ***canus*** sp. n. (p. 224)

– Scales on mesepisterna similar to those on adjacent part of elytra or, if smaller, then length normally > 8 mm 48

48 (47) Elytral processes elongate, tapering to a point, directed posteriad and curving mesad, caliper-like (Fig. 60). . . . . ***paradoxus*** sp. n. ♀ (p. 239)

– Elytral processes straight, diverging.
Males 49

49 (48) Ventrites 1 and 2 sparsely squamose in middle, the scales usually smaller than those on elytra and mostly well separated from each other. Scales on femora usually all smaller than those on elytra *or* of a markedly different colour.
Eyes moderately convex. Flagellum very short (Fig. 75) 50

– Ventrites 1 and 2 densely squamose throughout, the scales usually as large as those on elytra and ± contiguous. Scales on femora similar to those on elytra 52

50 (49) Setae in terminal fringes of elytral processes all very pale brown. Median lobe of aedeagus > × 3·5 as long as broad (Figs 174, 175).
Antennal funicle segments without any scales. . . . ***paradoxus*** sp. n. ♂ (p. 239)

– Setae in terminal fringes of elytral processes pale anteriorly, dark posteriorly. Median lobe of aedeagus stouter, < × 3·5 as long as broad 51

51 (50) Antennal funicle segments rarely with any scales. Scales on prothorax and elytra usually distinctly green, those on femora mostly coppery. Elytral processes, on average, longer: EPI 132–148 . . . . . ***cornutus virescens*** subsp. n. ♂ (p. 238)

– Antennal funicle segments 2 and 3 usually with a few very small ovate or elongate scales. Scales on prothorax and elytra pale grey or pearly, those on femora more metallic (sometimes coppery). Elytral processes, on average, shorter: EPI 122–134
cornutus cornutus Pascoe ♂ (Gulf District form) (p. 236)

52 (49) Inner margins of elytral processes ± straight, making a 'V' in antero-dorsal view.
Antennal funicle and fore tarsi normally devoid of scales 53

– Inner margins of elytral processes ± curved throughout their length, conjointly describing an uneven arc 56

53 (52) Scales on femora and vertex of head grey or pearly 54

– Scales on femora and vertex of head coppery or bronzy 55

54 (53) Average length about 9·5 mm. Scales on femora and vertex of head mostly dull bluish grey
hornabrooki sp. n. ♂ (p. 246)

– Average length about 7·5 mm. Scales on femora and vertex of head dull pale grey or pearly
ebrius ebrius Faust ♂ (upland forms) (p. 243)

55 (53) Elytral processes blade-like, outer half and apex abruptly flattened, forming a thin flange; interstria 1 raised at suture forming a low but sharp carina on declivity; strial granules inconspicuous. Eyes moderately convex . . . . ***ebrius angustus*** subsp. n. ♂ (p. 246)

– Elytral processes tapering, terete or with a distinct edge on outer side but not flattened; interstria 1 not, or bluntly, raised; strial granules usually conspicuous. Eyes strongly convex . . . . . ***ebrius wagneri*** subsp. n. ♂ (p. 245)

56 (52) Granules on elytral striae and disc of pronotum absent or indistinct. Antennal club stouter (Fig. 21). Average length 6·7 mm. Largest scales on ventrite 5 more than half as wide as those in middle of ventrite 2. Flagellum as long as median lobe of aedeagus
mus sp. n. ♂ (p. 240)

– Granules on elytral striae and disc of pronotum small but distinct. Antennal club more slender (Fig. 20). Average length > 7·0 mm. Largest scales on ventrite 5 usually less than half as wide as those on ventrite 2. Flagellum either much longer or much shorter than median lobe of aedeagus 57

57 (56) Antennal funicle segments 2 and 3 with dense, very broad scales; setae on these segments stout, truncate at apex, contrasting strongly with fine, pointed setae on segment 7.
Segments 1 and 2 of fore tarsi with dense broad scales; fore coxae usually with a few scales among the setae on anterior or mesal aspects 58

– Antennal funicle segments 2 and 3 with recumbent silky hairs and sometimes a few lanceolate or very small ovate scales; setae on these segments slender, usually finely pointed, differing little or not at all from those on segment 7 59

58 (57) Eyes moderately convex (Fig. 16). Average length 8·5 mm. Elytra proper widest at process bases (Fig. 56). Flagellum much shorter than median lobe of aedeagus
cornutus cornutus Pascoe ♂ (p. 235)

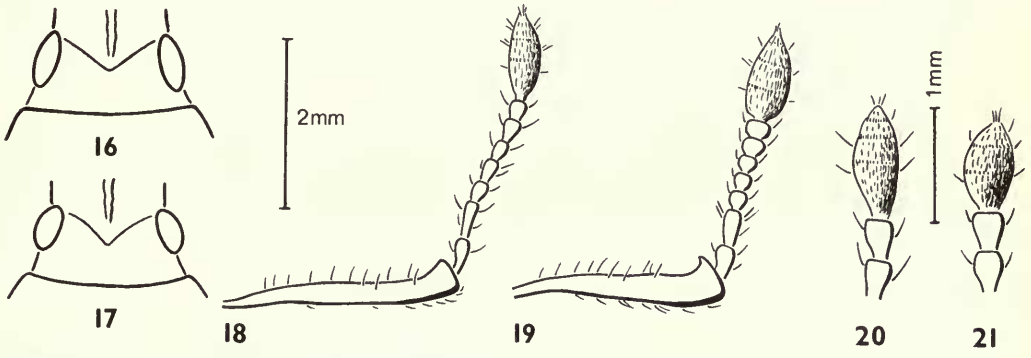
– Eyes strongly convex (Fig. 17). Average length 7·1 mm. Elytra proper widest in front of process bases (Fig. 64). Flagellum much longer than median lobe of aedeagus
ebrius ebrius Faust ♂ (lowland form) (p. 242)

59 (57) Shortest diameter of eye × 1·3–1·8 longest diameter of antennal scape in middle of length. Elytra proper widest in front of process bases (Figs 64, 73). Flagellum much longer than median lobe of aedeagus . . ***ebrius ebrius*** Faust ♂ (intermediate forms) (p. 242)

– Shortest diameter of eye × 1·9–2·4 longest diameter of antennal scape in middle of length. Elytra proper widest at process bases (Fig. 56). Flagellum much shorter than median lobe of aedeagus . . . . . ***cornutus tenuiscapus*** subsp. n. ♂ (p. 237)

60 (46) Spread of elytral processes fully as wide as elytra proper at their widest point (Fig. 63). Scales on ventrites 1 and 2 sparse and smaller than those on elytra.
Antennal funicle segments with silky hairs but no scales. Scales on prothorax and elytra usually distinctly green . . . . . ***cornutus virescens*** subsp. n. ♀ (p. 238)

– Spread of elytral processes narrower than elytra proper at their widest point. Scales on ventrites 1 and 2 dense and almost or quite as large as those on elytra 61



Figs 16–21 *Apirocalus* (*A.*) species. Heads of (16) *cornutus*, (17) *ebrius*. Antennae of (18) *acutus* ♂, (19) *acutus* ♀. Antennal club of (20) *ebrius*, (21) *mus*.

61 (60) Elytra with short but distinct, usually flattened processes (EPI 121–148) 62

– Elytral processes represented by stout angulations (EPI 106–124) 64

62 (61) Elytral processes cariniform, in line with, or parallel to, elytral outline (Fig. 58). Antennal funicle with dense scales on segments (1–)2–4(–6)
cornutus cornutus Pascoe ♀ (Brown River form) (p. 236)

– Elytral processes narrower, fin-like, diverging. Antennal funicle without, or with a few small scales on segments (1,) 2 and 3 only 63

63 (62) Setae towards sides of elytra about twice as long as those on femora, erect. Postero-ventral margin of prothorax with large erect setae, similar to those near sides of elytra and much longer than those at sides of prothorax. Length < 7 mm. Ventrites 3–5 fairly densely squamose . . . . . ***mus*** sp. n. ♀ (p. 240)

– Setae towards sides of elytra about as long as those on femora, ± recumbent. Postero-ventral margin of prothorax with a few small setae, at most as long as those at sides of prothorax. Length > 7 mm. Ventrites 3–5 with a few scattered scales only
ebrius angustus subsp. n. ♀ (p. 246)

64 (61) Antennal funicle segments 2 and 3 with dense, very broad scales; setae on these segments stout, pale, truncate at apex, contrasting strongly with fine dark setae on segment 7. 65

– Antennal funicle segments 2 and 3 with recumbent silky hairs and sometimes, in addition, a few lanceolate or very small ovate scales; setae on these segments slender, brownish, usually finely pointed, differing little or not at all from those on segment 7 . . . 66

65 (64) Average length 9 mm. Eyes usually only moderately convex (Fig. 16). Sides of elytra less strongly rounded; spread of processes only slightly less than greatest width of elytra proper (Fig. 57). Spermathecal duct about as long as spermatheca
cornutus cornutus Pascoe ♀ (p. 235)

– Average length 7·8 mm. Eyes more strongly convex (Fig. 17). Sides of elytra more strongly rounded; spread of processes distinctly less than greatest width of elytra proper (Fig. 65). Spermathecal duct several times length of spermatheca
ebrius ebrius Faust ♀ (lowland form) (p. 242)

66 (64) Scales on femora mostly dull bluish grey . . . . . ***hornabrooki*** sp. n. ♀ (p. 246)

– Scales on femora pale grey, pearly or pale bronzy brown 67

67 (66) Setae on leading edge of scape almost as long as its longest median diameter; shortest diameter of eye × 2·0–2·5 same measurement.
Eyes only moderately convex. Spermathecal duct about as long as spermatheca
cornutus tenuiscapus subsp. n. ♀ (p. 237)

– Setae on leading edge of scape distinctly shorter than its longest median diameter; shortest diameter of eye × 1·5–2·1 same measurement 68

68 (67) Eyes more strongly convex (Fig. 17). Setae on leading edge of scape ± erect (Fig. 14). Fore coxae without any scales. Spermathecal duct several times longer than spermatheca, convoluted 69

– Eyes less strongly convex (Fig. 16). Setae on leading edge of scape recumbent (Fig. 12). Fore coxae with a few scales among the setae. Spermathecal duct about as long as spermatheca, straight . . . ***cornutus cornutus*** Pascoe ♀ (Gulf District form) (p. 236)

69 (68) Granules in striae 1–3 at least as large as surrounding scales. Setae on postero-ventral margin of prothorax often very small and inconspicuous (as in ♂)
ebrius wagneri subsp. n. ♀ (p. 245)

– Granules in striae 1–3 smaller than surrounding scales. Setae on postero-ventral margin of prothorax always large and conspicuous (often visible from above)
ebrius ebrius Faust ♀ (upland forms) (p. 243)

Check-list

APIROCALUS Pascoe

Subgenus ***MOLOBRIUM*** subgen. n. (p. 207)
- ***gracilis***-group (p. 207)
  - ***gracilis*** **sp. n.**
  - ***stibicki*** **sp. n.**
- ***io***-group (p. 209)
  - ***io*** **sp. n.**
  - ***celatus*** **sp. n.**
  - ***occultator*** **sp. n.**
  - ***terrestris*** **sp. n.**
  - ***t. terrestris*** **subsp. n.**
  - ***t. dissidens*** **subsp. n.**

Subgenus ***APIROCALUS*** Pascoe (p. 214)
- ***fallax***-group (p. 214)
  - ***fallax*** **sp. n.**
  - ***insperatus*** **sp. n.**
  - ***asper*** Marshall
- ***avus***-group (p. 217)
  - ***subcostatus*** **sp. n.**
  - ***avus*** **sp. n.**
  - ***a. avus*** **subsp. n.**
  - ***a. intermedius*** **subsp. n.**
  - ***a. karimuicus*** **subsp. n.**
  - ***a. finisterrae*** **subsp. n.**
  - ***a. marawakanus*** **subsp. n.**
  - ***sedlaceki*** **sp. n.**
  - ***suppuratus*** **sp. n.**
  - ***canus*** **sp. n.**
- ***granulicollis***-group (p. 225)
  - ***granulicollis*** **sp. n.**
- ***nivosus***-group (p. 226)
  - ***nivosus*** **sp. n.**
  - ***atrigenua*** **sp. n.**
  - ***bacchusi*** **sp. n.**
- ***hydrographicus***-group (p. 229)
  - ***hydrographicus*** Marshall
  - ***orientalis*** **sp. n.**
  - ***ater*** **sp. n.**
  - ***vexillarius*** Marshall
  - ***inornatus*** **sp. n.**
- ***cornutus***-group (p. 233)
  - ***cornutus*** Pascoe
  - ***c. cornutus*** Pascoe
  - ***c. tenuiscapus*** **subsp. n.**
  - ***c. virescens*** **subsp. n.**
  - ***paradoxus*** **sp. n.**
  - ***mus*** **sp. n.**
  - ***ebrius*** Faust **stat. n.**
  - ***e. ebrius*** Faust
  - ***e. wagneri*** **subsp. n.**
  - ***e. angustus*** **subsp. n.**
  - ***hornabrooki*** **sp. n.**
- ***strigifrons***-group (p. 247)
  - ***strigifrons*** **sp. n.**
- ***acutus***-group (p. 248)
  - ***acutus*** **sp. n.**
- ***olivaceus***-group (p. 249)
  - ***stellifer*** **sp. n.**
  - ***olivaceus*** **sp. n.**
  - ***tenebricosus*** **sp. n.**
  - ***anatinus*** **sp. n.**

A. thomsoni Waterhouse, 1889 (St Aignan [Misima] I.) has been previously transferred to *Peteinus* Marshall by Marshall (1956 : 114). *A. gestroi* Pascoe, 1885 (Yule I.) is here transferred to a new genus (p. 253).

Descriptions of species

All descriptions of species are similarly constructed so as to facilitate comparison of a given structure in a range of species. In descriptions of higher categories, the characters are given roughly in order of importance but in both cases the genitalia are dealt with after the externals. Each species-description begins with a statement of range and altitude which will help to check the accuracy of the determination. Bionomic data are given in a separate section with, in each instance, the locality and collector's initials so that the full data of the specimens concerned can be found in the list of material examined.

All measures of length are given in metric units. Non-metric data are quoted as given, with the metric equivalent in square brackets. Place-names are also quoted as given. If an alternative spelling occurs on maps or in the Village Directory (Anonymous, 1968, Department of District Administration) this is added in square brackets but is not necessarily 'more correct'. Bionomic data are quoted strictly *verbatim*; I have not attempted to add or substitute scientific names of plants where only common names are given (or *vice versa*) or to check the current status of scientific names. Although paratypes of new species are sometimes mentioned in the section on doubtful records, other specimens there referred to are excluded from the type-series.

Subgenus *MOLOBRIUM* subgen. n.

Type-species: *Apirocalus io* sp. n.

Small species (4·5–7·5 mm). Elytral processes tuberculiform, erect or suberect in front view and inclined posteriad in side view. One or two much smaller accessory tubercles or granules sometimes present on outer side of main tubercle. Antennal scape claviform, not or indistinctly capitate. Sexes similar; prothorax about as long as broad but disc of pronotum more distinctly granulate in ♀. Abdominal ventrite 1 simple in ♀, concave or sulcate (sometimes very narrowly) in ♂; ventrite 5 usually simple in both sexes. Scales brown or greenish, generally dense but seldom imbricate, absent from antennal funicle and tarsi. Setae generally stiff, erect or suberect, parallel-sided and with truncate apices. Median lobe of aedeagus varying greatly between the species; upper surface often with a pair of smooth admedian carinae; flagellum short (rarely absent). Spermatheca compact and with distinct gland-lobe; styli of ovipositor × 3–4 as long as broad.

This subgenus occurs in the Central Highlands between 750 and 2500 m. Its range extends from the Star Mts in the east to the Huon Peninsula in the west and to Wau in the south (Maps 1, 2).

The name of this new subgenus is derived from a Greek word meaning 'young of wild swine'.

The earliest record known to me is of *A.* (*M.*) *terrestris* taken at Nondugl on 1st December 1950 by W. W. Brandt. The six species and one subspecies here recognized are all new and fall into two species-groups.

The *gracilis*-group

Elytral processes weakly diverging (Fig. 2). Arms of mesosternum and (adjacent) mesepisterna almost smooth and devoid of scales. Scales on antennal scape much smaller than those on pronotum. Setae on scape not, or only slightly, stouter than those on funicle. Median lobe of aedeagus × 3·3–3·5 as long as broad and × 0·9 as long as pronotum; struts × 1·3–1·4 as long as median lobe and × 1·2–1·3 as long as pronotum; flagellum × 0·2–0·3 as long as pronotum.

Apirocalus (Molobrium) gracilis sp. n.

(Figs 2, 86, 87, 88; Map 2)

Range. Northern Morobe District (Finisterre Range). Altitude: 1200–1500 m.

Length 6·2–6·9 mm. Black; legs and antennae very dark red or black. Scales on body uniform pale green or grey-green but sometimes brown with reddish reflexions between and in front of elytral processes; scales on head and legs pale green, grey or lilac, often with fiery golden red reflexions. *Head* with frons weakly declivous, making a weak angle with rostrum, its surface marked with irregular rugae which radiate from the deep but narrow rostro-frontal furrow and continue round back of eyes; area above eyes with a few pale suberect setae and fairly dense scales which thin out towards vertex with only a few behind eyes and a narrow patch of small scales and recumbent whitish setae against lower edge of eyes; eyes moderately convex. *Rostrum* widens evenly from base to near apex, pterygia only slightly wider than genae; dorsal surface ± flat, sides narrowed behind antennal insertions, with traces of a median carina in basal part and, above antennal insertions, a pair of mis-shapen shiny granules (sometimes indistinct); apex strongly rounded in profile view, epistome almost vertical, convex and polished, with a few small setiferous punctures, contrasting with adjacent strongly rugose area of apex; dense scales and pale setae present except on underside, in scrobes and on dorsal surface beyond level of antennal insertions. *Antennae* with funicle segment 2 slightly to distinctly longer than 1; remaining segments subequal, about half as long as 2 and all distinctly longer than broad; club × 2·6–2·8 longer than broad, widening fairly evenly from base to near middle; scape slender, very weakly sinuous, thickening only slightly in basal two-thirds, thence more strongly, apex rounded and with weak pre-apical constriction on anterior side; upper surface, in part, with very fine longitudinal rugulae and lipped punctures, between and around which lie small ovate scales (about half as large as those on pronotum), leaving the raised surfaces exposed; setae fine, brown and suberect on fore edge (longest exceeding greatest diameter of scape in middle of length), shorter and less erect elsewhere, only slightly coarser than those on funicle. *Prothorax* widest a little in front of middle; sides moderately and fairly evenly rounded; surface uneven, incompletely covered by scales, sometimes with some irregular shiny granules; setae much smaller than those on scape, brown or white, often strongly curved and ± recumbent, rather inconspicuous. *Elytra* ovate, disc weakly convex; main tubercle on interstriae 3–5 (♂) or 3–4 (♀), in latter case a small accessory granule present in interstria 5; main tubercles oval in section and surmounted by a prominent tuft of large white setae (× 2–3 as long as those on femora); TSI 66–70; strial punctures distinct and in regular rows on disc; interstriae subequal in width; scales uniform, dense but mainly separate, not covering surface completely (similar to those on pronotum); setae on sides and disc pale brown or white, very small and inconspicuous; those near sides (on interstriae 6 and 7) and on declivity larger (similar to those on scape), mainly brown but white around apex. *Mesepisterna* coarsely microreticulate and with a few (2–6) very small ill-defined punctures containing very small appressed pale setae (about as long as diameter of puncture) but no scales; arms of mesosternum with 1–4 similar setiferous punctures but surface usually highly polished, at least in middle. *Metasternum* flat in middle; scales near sides similar to those on elytra, becoming less dense in middle; ventrites 1 and 2 with some similar scales towards sides, ventrite 5 with a few smaller scales; setae throughout sterna and venter fine, erect or suberect, pale and iridescent (whitish near sides), those on metasternum and ventrites 1 and 2 varying in size but on average as long as (but finer than) those on femora; those on ventrites 3–5 about half as long, irregularly distributed on ventrite 5 but arranged in a single fairly regular transverse row on 3 and 4. *Legs* with femora moderately swollen; fore and hind straight, middle femora slightly reflexed dorsad; fore tibiae weakly, middle tibiae very weakly, incurved towards apex; hind tibiae straight; inner (ventral) edge of fore tibiae sinuate and with distinct teeth; inner edges of middle and hind tibiae straight and with smaller teeth; scales on femora smaller than those on elytra, irregularly distributed, mostly separate; those on tibiae smaller than those on femora; setae whitish throughout except towards apices of tibiae (brown). *Sexual dimorphism* slight; ventrite 1 concave in ♂, ± flat in ♀; single ♀ examined has smaller main elytral tubercles with an accessory granule in interstria 5 and surface of disc of pronotum is more uneven and with larger, more distinct granules than in ♂.

Genitalia. Median lobe of aedeagus (Figs 86, 87) as long as pronotum, × 3·5 as long as broad, tapering and arched in apical third, apex bluntly rounded; upper surface with traces of a pair of longitudinal carinae in basal third; struts × 1·3 as long as median lobe, manubrium < × 0·6 as long as median lobe, flagellum × 0·2 as long. Spermatheca (Fig. 88) normal; spermathecal gland claviform, arising from a broad but distinct prominence; spermathecal duct about equal to overall length of spermatheca; spout unpigmented.

Holotype ♂, PAPUA NEW GUINEA: Finisterre Range, Saidor, Matoko [1500 m], 29.viii–5.ix.1958 (*W. W. Brandt*), in BPBM.

Paratypes. PAPUA NEW GUINEA: 1 ♂, same data as holotype (BMNH); 1 ♀, ditto except 6–24.ix.1958; 1 ♂, Saidor, Funyende, 1200 m, 24.ix.1958 (*W. W. Brandt*) (both in BPBM).

Specimens examined: 4; dissected: 3 (2 ♂, 1 ♀).

Apirocalus (Molobrium) stibicki sp. n.

(Figs 31, 89–91; Map 2)

Range. Northern Morobe District. Altitude: 1800 m.

♂. Length 6·9 mm. Black in all its parts. Scales pale grey-brown with coppery reflexion. *Head* and *rostrum* as in *A. gracilis* except frons more steeply declivous. *Antennae* as in *A. gracilis* except setae on scape even less coarse, closely resembling those on funicle. *Prothorax* widest a little in front of middle, there strongly rounded, tapering thence to extremities; surface of disc uneven, with a few small, irregular shiny granules; scales dense but not covering surface completely; setae much smaller than those on scape, brown and inconspicuous. *Elytra* (Fig. 31) oblong-ovate, disc flat; main tubercles in interstriae 3–4 (also encroaching on 2), oval in section and more strongly inclined posteriad than in *A. gracilis*; much smaller accessory tubercle in interstria 5 and granule in 6, all three in a straight line which, if produced round side of elytra would reach metasternum; TSI 57; strial punctures distinct and in regular rows on disc; interstriae 3 and 5 wider than 2 and 4; some slight development of sinuous transverse folds across disc; a scale-sized, bead-like setiferous granule is associated with each strial puncture and similar granules, similarly spaced, occur along each interstria; scales dense and uniform but great majority are separate, not covering surface completely; setae as in *A. gracilis* but all brown except some around apex and on anterior side of tubercles; setae on tubercles at most only twice as long as those on femora. *Mesepisterna* as in *A. gracilis*; arms of mesosternum coarsely microreticulate and without punctures or setae. *Metasternum* with depressions behind middle coxae which leave a raised median area; ventrite 1 with a very narrow median sulcus (× 0·15 width of intercoxal process), delimited by very slender smooth rugiform carinae; scales and setae as in *A. gracilis*. *Legs* as in *A. gracilis* but tibial teeth indistinct, fore tibiae strongly incurved in distal third and setae mostly pale brown or hyaline.

Aedeagus (Figs 89–91) × 0·86 as long as pronotum, × 3·3 as long as broad, strongly arched, apical region tapering to a blunt point, upper surface without any carinae; struts × 1·4 as long as median lobe, manubrium shorter than median lobe, flagellum × 0·3 as long.

Holotype ♂, PAPUA NEW GUINEA: Morobe District, Lae, Melambi R[iver], Zitare Vill[age], 6000 [ft] [1800 m], 25.xii.1956 (*J. H. Ardley*), in BMNH.

Named after Dr J. N. L. Stibick, Senior Entomologist, DAPM, who sent me the specimen.

The *io*-group

Elytral processes erect. Arms of mesosternum and (adjacent) mesepisterna with scales; mesepisterna strongly punctured. Scales on antennal scape almost as large as those on pronotum. Setae on leading edge of scape usually distinctly stouter than those on funicle. Median lobe of aedeagus × 1·8–2·7 as long as broad and × 0·5–0·8 as long as pronotum; aedeagal struts × 1·7–3·2 as long as median lobe and × 1·3–1·7 as long as pronotum; flagellum × 0·3–0·6 as long as pronotum (rarely absent).

Distinguished from the *gracilis*-group by the shorter median lobe of the aedeagus and the longer struts and by the squamose and more strongly punctured mesepisterna. The legs and antennae are stouter than in the *gracilis*-group; the scales are larger and denser (especially on the pronotum) and the setae on the body are generally longer and stouter.

Apirocalus (Molobrium) io sp. n.

(Figs 30, 85, 92, 93, 103, 104; Map 2)

Range. Morobe District. Altitude: 750–1400 m.

Length 5·3–6·2 mm ($\bar{x}$ (10) = 5·7). Black; parts of legs and antennae very dark red. Scales mainly bronzy or coppery when clean, sometimes variegated with paler scales. *Head* with frons declivous, making a distinct angle with rostrum, its surface (beneath the scales) with fine rugulae, radiating from the very deep well defined rostro-frontal furrow; vestiture as in *A. gracilis*; eyes strongly convex. *Rostrum* parallel-sided in middle or widening continuously from base; pterygia prominent, distinctly wider than genae; median rostral carina variable, usually well defined and very broad (often as broad as funicle) but very low and tapering to a point posteriorly (otherwise as in *A. gracilis* but with no granules above antennal insertions). *Antennae* with funicle segment 2 slightly longer than 1, 3–7 subequal, about half as long as 2,

shortest (5 or 6) slightly longer than broad; club ×2·3 as long as broad; scape thickens evenly from near base to very near apex with scarcely any trace of apical expansion; densely squamose (except around funicle insertion) and with stout, weakly curved brown or brown+white setae, suberect on fore edge, shorter and less strongly raised elsewhere, the longest longer than greatest diameter of scape in middle of length; funicle segments with fine brown setae and very fine recumbent hairs, sparse on basal segments but becoming denser apically. *Prothorax* widest at or a little in front of middle, there strongly rounded, tapering thence to extremities; surface covered with deep irregular pits (concealed by scales), disc sometimes with bead-like granules, the largest of which are arranged in two admedian rows; setae similar to those on antennal scape, smaller and brown on disc, larger and brown or white towards sides, all pointing towards mid-line. *Elytra* ovate or rotund (some ♀); disc ± flattened; tubercles regularly cone-shaped, situated in interstriae 2–4, adjacent sections of interstriae 5 and 6 weakly convex; TSI 35–41 ($\bar{x}$ (13) = 38); strial punctures fairly regular, sometimes disturbed on disc by weak development of sinuous transverse folds; very small setiferous granules (smaller than a scale) in single rows on interstriae in ♂, similar or < twice as large in ♀; setae on disc similar to those on scape, semi-erect and brown, elsewhere larger (about twice as long as those on femora), often fully erect, almost straight, mostly brown (Fig. 30); tubercles with dark brown setae which do not form apical tufts. *Mesepisterna* with dense scales, as large as those on elytra and often slightly larger than those on arms of mesosternum. *Metasternum* and ventrites 1–2 densely squamose and with numerous white setae resembling those on pronotum; ventrites 3–5 with sparser, much smaller scales and smaller, mainly brownish setae. *Legs* with all femora inflated and weakly reflexed dorsad; fore and middle tibiae weakly and fairly evenly incurved, hind tibiae almost straight; hind tarsal claw-segment ×1·9–2·0 as long as segment 3; scales dense on exposed parts of femora and on outer (dorsal) aspect of tibiae; femora with a patch of pale scales on underside of swollen part; setae similar to those on prothorax, mainly whitish, especially on widest part of femoral swelling. *Sexual dimorphism* slight; ventrite 1 of ♂ has a shallow longitudinal sulcus, sides of which are raised but do not form distinct carinae; width of this sulcus is less than half that of intercoxal process of ventrite 1; ventrite 5 simple. Ventrite 1 of ♀ simple; ventrite 5 with an irregular elevation on disc, often excavated on its posterior aspect. Elytra of ♀ usually broader and more strongly rounded than those of ♂.

Genitalia. Median lobe of aedeagus (Figs 92, 93) ×0·7–0·8 as long as pronotum, ×2·5–2·7 as long as broad; upper surface with a pair of large black longitudinal carinae which project apicad over phallotreme; struts ×1·7 as long as median lobe, flagellum ×0·3 as long (single observations). Spermatheca (Figs 103, 104) normal; spermathecal gland pedunculate, arising from a large prominence; spermathecal duct only slightly exceeding overall length of spermatheca; spout straight, unpigmented.

Holotype ♂, PAPUA NEW GUINEA: Morobe District, Wau, 1200 m, 2–10.xi.1961 (*J. & M. Sedlacek*), in BPBM.

Paratypes. PAPUA NEW GUINEA: 2 ♀, same data as holotype (BPBM, BMNH); 2 ♂, 1 ♀, ditto except 12.vii.1961 (2 BPBM, 1 BMNH); 1 ♂, ditto except 17.vii.1961; 1 ♀, ditto except 15.viii.1961 (*J. Sedlacek*) (both BPBM); 1 ♀, Wau, 3450 ft [1035m], 10.xi.1954 [*Szent–Ivany*] (DAPM); 1 ♂, Wau, 1400 m, 27.viii.1961 (*J. Sedlacek*) (BMNH); 1 ♀, ditto except 1200 m, 1–3.x.1963; 1 ♀, Bulolo, 750 m, 5.x.1965 (*J. Sedlacek*) (both BPBM); 4 ♀, Herzog Mts, Vagau, Station No. 137, *c.* 4000 ft [1200 m], 4–17.i.1965 (*M. E. Bacchus*) (BMNH).

Specimens examined: 16; dissected: 7 (2 ♂, 5 ♀).

Bionomic data. 'On pumpkin flowers' (Wau, S–I).

The name given to this species commemorates my great pleasure at finding such a distinctive aedeagus in this otherwise undistinguished weevil. I have made it the type-species of the subgenus *Molobrium* in preference to *A. terrestris* (a more obviously suitable choice) partly on account of its distinctive aedeagus and partly because, although its range appears to be restricted, it contains the Wau Ecology Institute, which should mean that this species is more readily accessible for study than the others.

Apirocalus (Molobrium) celatus sp. n.

(Figs 94–96, 100, 101; Map 2)

Range. Eastern Highlands. Altitude: 1350 m.

Length 6·0–6·8 mm ($\bar{x}$ (9) = 6·4). Black; parts of legs and antennae very dark red. Scales bronzy, pearly or greenish when clean. *Head* with frons rather steeply declivous, making a distinct angle with rostrum, its surface with irregular rugae radiating from the deep rostro-frontal furrow; vestiture as in

A. gracilis; eyes strongly convex. *Rostrum* ± strongly constricted between base and pterygia; median carina variable; otherwise as in *A. io*. *Antennae* with funicle segments as in *A. io*; club ×2·1–2·5 as long as broad; scape thickens rather abruptly in distal third, fore edge with very weak pre-apical constriction; vestiture as in *A. io*. *Prothorax* as in *A. io* except bead-like granules on disc seldom arranged in rows and setae towards sides mostly white and pointing towards centre of disc. *Elytra* ovate, flattened on disc; main tubercle situated in interstriae 3–4, its base encroaching on 2; on its outer side is a small accessory tubercle, partly fused with the large one yet distinct from it and clearly standing in interstria 5; TSI 48–57 ($\bar{x}$ (6) = 53); otherwise as in *A. io* except setae never fully erect and those on interstriae 6 and 7 often white; main tubercles surmounted with an untidy tuft of very large setae, whitish on anterior side of tubercle and dark brown on posterior side; accessory tubercles with a tuft of 2–4 brown setae. *Mesepisterna* with a few small scales only; those on arms of mesosternum larger and denser. *Metasternum* and venter as in *A. io*. *Legs* with fore femora inflated, mainly on antero-dorsal aspect, hence markedly asymmetrical; middle and hind femora progressively less inflated and less asymmetrical; fore and middle tibiae weakly incurved towards apex, hind tibiae ± straight; hind tarsal claw-segment ×1·9–2·5 as long as segment 3; scales and setae as in *A. io* except femora without pale patch. *Sexual dimorphism* slight; ventrite 1 of ♂ has a broad, very deep median sulcus, delimited by a pair of prominent longitudinal carinae; although sulcus may extend shallowly on to ventrite 2, the carinae terminate rather abruptly at the interventrital suture; ventrite 1 of ♀ without any sulcus or carinae.

Genitalia. Median lobe of aedeagus (Figs 94–96) about half as long as pronotum and twice as long as broad; upper surface with a pair of large admedian carinae in basal half; apical half very strongly concave; struts ×2·5 as long as median lobe, manubrium distinctly longer than median lobe, flagellum *c.* ×0·7 as long. Spermatheca (Figs 100, 101) etc., as in *A. io* but spout sometimes pigmented.

Holotype ♂, PAPUA NEW GUINEA: Eastern Highlands, Kassam, 48 km E. of Kainantu, 1350 m, 28.x.1959 (*T. C. Maa*), in BPBM.

Paratypes. PAPUA NEW GUINEA: 1 ♂, same data as holotype (BMNH); 4 ♀, ditto except 7.xi.1959 (3 BPBM, 1 BMNH); 1 ♂, 2 ♀, Kassem Pass, 24.ii.1974 (*R. Hornabrook*) (2 RWH, 1 BMNH).

Specimens examined: 9; dissected: 5 (2 ♂, 3 ♀).

Kassam is believed to be much nearer Kainantu than stated above.

The name ('hidden') refers to the close superficial resemblance between this species and the following.

Apirocalus (Molobrium) occultator sp. n.

(Figs 79, 80, 84, 97–99, 102; Map 2)

Range. Madang District (Finisterre Range). Altitude: 1065–1665 m.

Length 5·8–6·8 mm ($\bar{x}$ (10) = 6·2). Black; parts of legs and antennae very dark red. Scales mainly bronzy or greenish when clean. *Head* with frons weakly declivous, making a very weak angle with rostrum, its surface weakly, often confusedly rugose; vestiture as in *A. gracilis*; eyes strongly convex. *Rostrum* ± strongly constricted between base and pterygia; median carina variable; otherwise as in *A. io*. *Antennae* as in *A. io*; club ×2·4–2·7 as long as broad. *Prothorax* as in *A. io*. *Elytra* ovate, flattened on disc; base of main tubercle ill-defined but covering interstriae 2–5; usually with a small accessory granule on outer aspect, often high up on side of main tubercle (sometimes indistinct); TSI 47–55 ($\bar{x}$ (8) = 52); strial punctures distinct and regular; surface of disc even, with little or no trace of sinuous transverse folds; vestiture as in *A. celatus*. *Mesepisterna*, etc. as in *A. celatus*. *Metasternum* and venter as in *A. io*. *Legs* as in *A. celatus* but fore femora less strongly inflated and less asymmetrical. *Sexual dimorphism* very slight; ventrite 1 of ♂ with broad ill-defined sulcus, not present in ♀.

Genitalia. Median lobe of aedeagus (Figs 97–99) ×0·5–0·7 as long as pronotum and ×1·8–2·1 as long as broad; upper surface with a pair of admedian carinae in basal fourth; struts ×2·5–2·8 as long as median lobe, manubrium about as long as median lobe, flagellum absent; anterior end of internal sac with a pair of bilobed invaginations (Figs 79, 80); opening of ejaculatory duct not located with certainty. Spermatheca (Fig. 102) normal; spermathecal gland arising from an indistinct prominence; spermathecal duct shorter than overall length of spermatheca; spout curved, tapering and pigmented, with very thick wall and narrow lumen (Fig. 84).

Holotype ♂, PAPUA NEW GUINEA: Madang District, Finisterre Range [Naho river valley], Damanti, 3550 ft [1065 m], Station No. 30, 2–11.x.1964 (*M. E. Bacchus*), in BMNH.

Paratypes. PAPUA NEW GUINEA: 1 ♀, same data as holotype; 1 ♂, ditto except Station No. 46; 1 ♂, Finisterre Range, Budemu [Butemu], Station No. 51, *c.* 4000 ft [1200 m], 15–24.x.1964 (*M. E. Bacchus*); 1 ♂, 1 ♀, Finisterre Range, Moro, Station No. 78, *c.* 5550 ft [1665 m], 30.x–15.xi.1964 (*M. E. Bacchus*) (all BMNH); 3 ♂, 1 ♀, ditto except Station No. 85 (3 BMNH, 1 BPBM).

Specimens examined: 10; dissected: 5 (3 ♂, 2 ♀).

Bionomic data. 'Ex rotting vegetation' (Moro, Station No. 85).

This species is very remarkable for its lack of a flagellum and for the curious invaginations at the anterior end of the internal sac in the male. The strongly sclerotized beak-like spout in the bursa copulatrix of the female also has no parallel among the other species. Externally, however, it closely resembles the other members of the species-group; this circumstance suggested its name ('concealer').

Apirocalus (Molobrium) terrestris sp. n.

(Figs 78, 105, 107–110; Map 2)

Range. Eastern, Western and Southern Highlands; Star Mts. Altitude: 1200–2500 m.

Length 4·6–6·3 mm. Black; parts of legs and antennae very dark red. *Head* with frons declivous, making a distinct angle with rostrum, its surface weakly rugose; scales imbricate above eyes, thinning out towards vertex and behind eyes, otherwise as in *A. gracilis*; eyes very strongly convex. *Rostrum* parallel-sided or weakly constricted between base and pterygia, which are usually weak; dorsal surface flat or evenly arched, sides slightly narrowed behind antennal insertions, apex strongly rounded (in profile view), epistome scarcely distinguishable; median rostral carina very variable (sometimes indistinct); vestiture as in *A. gracilis*. *Antennae* with funicle segment 2 = or < × 1·4 as long as 1, 3–7 subequal, about half as long as 2, shortest (usually 5) usually slightly broader than long; club × 2·0–2·6 as long as broad; scape as in *A. io* except setae on fore edge less erect and longest *not* exceeding greatest diameter of scape in middle of length; recumbent hairs on funicle denser on segments 6 and 7. *Prothorax* widest at, or a little in front of, middle; sides moderately rounded in middle, often with a very weak pre-apical constriction; surface very coarsely pitted, often uneven, often with traces of a narrow median sulcus; granules, when present, often divided along mid-line into two irregular admedian rows; scales dense; setae resemble those on scape and all point towards centre of disc. *Elytra* ovate; sides of disc flat or weakly concave; suture (interstria 1) raised on declivity and sometimes throughout its length; interstria 5 and sometimes also 3, more prominent than the others; main tubercle situated in interstriae 2–4; adjacent parts of interstriae 5 and 6 usually convex or even costate but without any tubercles or granules; TSI 40–51; strial punctures deep and fairly regular; interstriae with or without small bead-like setiferous granules (no larger than surrounding scales); scales very similar to those on pronotum, strongly appressed, dense, sometimes tessellate but not imbricate; setae similar to those on antennal scape, those near sides of elytra always less than twice as long as those on femora, those on declivity slightly larger, those on disc much smaller and inconspicuous (those on sides and all those in striae smaller still); tubercles surmounted with a loose, untidy tuft of large, often mainly whitish, setae. *Mesepisterna* (posteriorly) and arms of mesosternum with scales of similar size and density. *Metasternum* and venter as in *A. io* but setae finer. *Legs* with femora all about equally swollen; tibiae as in *A. celatus*; hind tarsal claw-segment × 1·8–2·0 as long as segment 3; vestiture as in *A. io* except middle and hind femora with a ± distinct ring of pale scales at widest point. *Sexual dimorphism* very slight; ventrite 1 of ♂ with an ill-defined, usually shallow sulcus, occupying less than half width of intercoxal process, flanked by either coarse irregular rugae or flattened matt areas; pronotum and elytra usually without any bead-like granules projecting through the scales. Ventrite 1 of ♀ sometimes weakly concave but with small bead-like granules on elytra and disc of pronotum.

Genitalia. Median lobe of aedeagus half as long as pronotum, oblong, very weakly curved and with no trace of carinae on upper surface; struts × 2·8–3·2 as long as median lobe. Spermatheca (Figs 105, 106) normal; spermathecal gland linear or claviform, arising from a distinct prominence; spermathecal duct *c.* × 3 overall length of spermatheca; spout straight and unpigmented.

Readily distinguished from *A. celatus* by the lack of accessory elytral tubercles and from *A. io* by its less erect setae, notably on the antennal scape. Clean specimens can be distinguished from *A. occultator* by the larger and more numerous scales on their mesepisterna.

Apirocalus (Molobrium) terrestris terrestris subsp. n.

(Figs 78, 105, 107–110; Map 2)

Range. Eastern, Western and Southern Highlands. Altitude: 1500–2500 m.

Length 4·6–5·9 mm ($\bar{x}$ (22) = 5·2). Scales appear dull brown but are bronzy, coppery or pearly when clean, sometimes forming a variegated pattern on elytra; TSI 40–51 ($\bar{x}$ (12) = 45).

Genitalia. Median lobe of aedeagus (Figs 107–110) × 2·1–2·2 as long as broad; flagellum as long as median lobe.

Holotype ♂, Papua New Guinea: Eastern Highlands, Okapa, *c.* 5000 ft [1500 m], Station No. 185, 10–11.ii.1965 (*M. E. Bacchus*), in BMNH.

Paratypes. Papua New Guinea: 1 ♂, same data as holotype except Station No. 170 and 4–15.ii.1965; 1 ♀, Wanatabe Valley, near Okapa, Station No. 174, 5.ii.1965 (*M. E. Bacchus*) (both BMNH); 1 ♂, Purosa, 1700 m, 17–25.v.1966 (*Gressitt & Tawi*) (BPBM); 3 ♂, 6 ♀, Aiyura, 1600 m, 25.ix.1972 (*A. J. Kimber*) (6 DAPM, 3 BMNH); 1 ♂, 2 ♀, same locality, 5400 ft [1620 m], 20.ii.1958 (*J. H. Barrett*) (2 DAPM, 1 BMNH); 1 ♂, ditto except 30.x.1954 (*A. Schindler*); 1 ♀, same locality, 6000 ft [1800 m], 23.x.1954; 1 ♀, Oyihaka Pltn, 5400 ft [1620 m] (no date); 1 ♂, Goroka, 5200 ft [1560 m], 29.x.1954 (all *Szent-Ivany*) (all DAPM); 3 ♂, Goroka, G. Pentland's plantation, 5200 ft [1560 m], 26.iv.1955 (*Szent-Ivany*) (2 DAPM, 1 BMNH); 2 ♂, 1 ♀, Western Highlands, Nondugl, 1.xii.1950 [*W. W. Brandt*] (ANIC); 1 ♂, Hagen Town, 4° 43′ S, 144° 17′ E, 1650 m, 30.v.1966 (*Gressitt*); 2 ♂, Lake Sirunki, 14 and 16.vi.1963; 1 ♀, Yaibos, 2200–2150 m, 10.vi.1963; 1 ♀, 6–12 km W of Wabag, 2020–2400 m, 13.vi.1963; 1 ♂, Kepilam, 2450–2600 m, 22.vi.1963 (all *J. Sedlacek*) (all BPBM); 1 ♂, 1 ♀, Kandep area, slope above Lai river valley, *c.* 7800 ft [2340 m], 16.ii.1964; 1 ♂, Southern Highlands, Mendi, Methodist Mission Station, 5000 ft [1500 m], 14.ix.1960 (all *Szent-Ivany*) (all DAPM).

Specimens examined: 35; dissected: 13 (9 ♂, 4 ♀).

Bionomic data. 'Feeding on ripe strawberries' (Aiyura, AJK); ' x soil' (Aiyura, JHB); 'On ground under coffee bush' (Goroka, S-I); 'Feeding on sweet potato foliage' (Lai river valley, S-I); 'Orn. garden, on *Euphorbia pulcherrima*' (Mendi, S-I); 'On coffee (suspected ring-borer)' (Oyihaka Pltn, S–I; Aiyura, AS).

The smallest member of the genus. Its range is unusually extensive for a montane taxon but no localized variation has been detected.

Apirocalus (Molobrium) terrestris dissidens subsp. n.

(Figs 106, 111, 112; Map 2)

Range. Star Mts. Altitude: 1200–*c.* 2000 m.

Length 5·9–6·3 mm. Scales mainly pale grey or greenish when clean. TSI 45–50 ($\bar{x}$ (7) = 47). Otherwise resembles nominate subspecies.

Genitalia. Median lobe of aedeagus (Figs 111, 112) × 2·3–2·4 as long as broad, apex more distinctly truncate than in nominate subspecies; flagellum × 0·8 as long as median lobe.

Holotype ♂, Irian Jaya: Star Mts, Sibil, 1260 m, 2.v.1959 (*Leiden Mus. Neth. N. G. Exp.*), in RNH.

Paratypes. Irian Jaya: 1 ♂, same data as holotype except 17.v.1959 (RNH); 1 ♀, ditto except 2.vi.1959 (BMNH); 1 ♂, Beta Bip, Kampong, 1320 m, 11.iv.1959 (*Leiden Mus. Neth. N. G. Exp.*) (RNH). Papua New Guinea: 2 ♂, West Sepik District, Eliptamin Valley, 1665–2530 m, 19.vi.1959 (*W. W. Brandt*) (BPBM, BMNH); 1 ♀, Feramin, 150–120 m [?], 23–31.v.1959 (*W. W. Brandt*) (BPBM).

Specimens examined: 7; dissected: 3 (2 ♂, 1 ♀).

In spite of its greater size, I regard this taxon as a subspecies of *A. terrestris* because the differences between their aedeagi are slight compared with those between the aedeagi of the other members of the subgenus.

Subgenus *APIROCALUS* Pascoe

Apirocalus Pascoe, 1881 : 590. Type-species: *Apirocalus cornutus* Pascoe, by monotypy.

Small to medium-sized species (5·5–12·0 mm). Elytral processes vary greatly between the species and often exhibit strong sexual dimorphism; they usually arise from sides of elytral declivity and diverge strongly postero-laterad. Although typically elongate and flattened, they are often very short or represented by obtuse angulations (especially in ♀); no accessory processes present but base often swollen or with a rounded swelling on inner (mesal) aspect. Antennal scape varies greatly (Figs 4–15); funicle and tarsi sometimes with scales. Ventrite 1 simple in both sexes; ventrite 5 sometimes foveate, especially in ♂. Median lobe of aedeagus variable (especially between species-groups), without or (rarely) with *sharp* admedian carinae on its upper surface; flagellum and spermatheca variable (see under species-groups).

This subgenus has the same range as the genus as a whole (p. 195, Map 1) and occurs over the same range of altitude.

It is doubtful whether the marginal elytral processes of this subgenus are homologous with the admedian processes of subgenus *Molobrium*. The basal swellings referred to above occupy the same position as the admedian processes of *Molobrium* but the relationship between these structures is uncertain.

The *fallax*-group

Elytra typically with very short angular processes, each with a rounded swelling on its meso-dorsal aspect (sometimes indistinct). Surface of elytral disc ± uneven and often with shiny bead-like granules on both striae and interstriae. Prothorax about as long as broad in both sexes, disc of pronotum slightly more strongly granulate in ♀ than in ♂ (on average). Antennal club × 0·3–0·4 as long as pronotum; scape slender, often crooked, apex either simple or capitate; setae on fore edge stiff, erect or suberect, mostly longer than greatest diameter of scape in middle of length, similar to those on funicle but stouter and blunt-tipped; scales on scape much smaller than those on pronotum; funicle segments without scales, tarsi rarely with a few scales on segment 2. Arms of mesosternum and mesepisterna with scales; mesepisterna strongly punctured. Median lobe of aedeagus × 1·8–3·0 as long as broad and × 0·5–0·6 as long as pronotum, moderately to very strongly curved, apical region strongly tapering, tip rounded or weakly spatulate, upper surface sometimes with a pair of sharp admedian carinae; struts × 2·7–3·4 as long as median lobe and × 1·5–1·8 as long as pronotum; flagellum short, × 0·4–0·7 as long as pronotum. Spermatheca linear, tail short, strongly reflexed; gland-lobe cylindrical, its axis making only a small angle with that of body; gland small, claviform; duct much longer than spermatheca. Styli of ovipositor × 3·8–5·5 as long as broad.

This group resembles subgenus *Molobrium* in general appearance and in combining close external similarity with strong genitalic differences. The proportions of the male genitalia are quite similar to those of the *io*-group of subgenus *Molobrium*. Two of the three known species are new.

Apirocalus (Apirocalus) fallax sp. n.

(Figs 4, 32–37, 113–117, 123–125; Map 4)

Range. Morobe District and Owen Stanley Range. Altitude: 800–1950 m.

Length 6·2–7·5 mm ($\bar{x}$ (25) = 7·0). Head, body, coxae and tarsi black or reddish black; antennae, trochanters, femora and tibiae very dark red. Scales on head, body and legs usually bright rust-brown but sometimes bronzy or greenish. *Head* and *rostrum* as in *A. io* except dorsal surface of rostrum transversely convex behind antennal insertions (not flat), pterygia less prominent and with their rims produced postero-ventrally to level of lower margins of eyes; setae on squamose areas smaller, inconspicuous. *Antennae* with funicle segments 1 and 2 subequal and *c.* × 2·5 as long as broad; segments 3–7 subequal (4 and 5 shortest) and × 1·1–1·8 as long as broad, widening progressively (but very slightly) towards apex; club × 2·1–2·5 as long as broad, widening evenly from base; scape varying from almost straight to distinctly sinuous or crooked, thickening (dorso-ventrally) in apical third but widening only a little, or not at all, beyond basal fourth; apex ± distinctly capitate; upper surface with very fine longitudinal rugulae and small setiferous granules, between and around which lie small ovate scales (usually about

half as large as those on pronotum), leaving the raised surfaces exposed; setae on fore edge brown, often fully erect, weakly curved, the longest exceeding greatest diameter of scape in middle of length (Fig. 4); setae on hind edge about half as long, subrecumbent; recumbent silky hairs absent or very sparse on funicle segments 1–5, more numerous on 6 and 7. *Prothorax* widest about middle, there moderately rounded, tapering evenly to apex and almost as strongly to base (often weakly and smoothly constricted in basal third); disc broadly flattened in basal two-thirds, its surface uneven, with numerous bead-like granules of various sizes, the largest × 2 (in some specimens)–4·7 diameter of surrounding scales, concentrated near mid-line and often divided by traces of a median furrow; scales lying densely and awkwardly in the deep depressions between granules and rugae; sides of prothorax with very large, fairly regular punctures and no granules; scales here ± imbricate in upper part, becoming sparse below level of widest point and dense again around fore coxae; setae brown or whitish, much smaller than those on antennal scape, subrecumbent and inconspicuous. *Elytra* subovate, disc ± flattened, its surface uneven, with a ± distinct elevation on basal part of interstria 3 (or 3–5) and another (sometimes) on intermediate part of 7; elytral processes very short, their angulate or rounded edges projecting subhorizontally from interstria 5; basal swellings (in interstriae (2–)3–4) variably developed (sometimes obsolete), their centres about level with apices of processes (Figs 32, 36); striae well marked in spite of surface irregularities, interstriae 3 and 5 distinctly broader than 2 and 4; granulation of disc varies from small (scale-sized) setiferous granules on interstriae only, to larger granules (< × 3 diameter of scales) on both interstriae and striae, those on former often irregular in size and arrangement; scales separate on disc, contiguous on declivity and processes, condensed and often imbricate at base of interstria 6; scales on sides vary in size and density and are apparently subject to abrasion by legs; setae linear or linear-lanceolate, semi-erect, brown, pale brown or whitish, small and inconspicuous on disc, larger near sides and varying greatly in size on each interstria, from same length as those on femora to twice as long; those on declivity intermediate in length, white around apex; processes with a tuft or fringe of very long, soft, linear-lanceolate, bright pearly setae. *Mesepisterna* strongly punctured and with a cluster of contiguous scales in posterior part, about as large as those on adjacent part of elytra; arms of mesosternum occasionally punctured and with a few similar scales. *Metasternum* and ventrites 1 and 2 with small ovate well separated scales in middle, becoming much larger, round and contiguous towards sides (those near sides of metasternum often larger than those on elytra); ventrite 5 with some small scales; ventrites 3 and 4 with few, if any, scales; setae semi-erect, whitish, similar to those on femora but finer. *Legs* with femora moderately swollen, middle and sometimes hind femora weakly curving dorsad, fore femora often weakly curving ventrad; fore tibiae distinctly to strongly incurved towards apex, middle tibiae not, or weakly, incurved, hind tibiae straight; hind tarsal claw-segment × 1·8–2·1 as long as segment 3; exposed parts of femora and tibiae with contiguous or subcontiguous scales, often larger and brighter on or beneath femoral swelling; setae curved, whitish, semi-erect (recumbent on knees), often arising from very small bead-like granules. *Sexual dimorphism* moderate; ventrite 5 of ♂ with large crater-like fovea, its rim formed posteriorly by edge of ventrite, laterally by a pair of posteriorly diverging carinae, with a gap anteriorly between ends of these carinae; ventrite 5 of ♀ often with traces of same fovea and carinae. Elytral processes of ♂ distinctly angulate, usually wider than elytra and separated from widest part of elytra proper by a constriction (Fig. 32); processes of ♀ rounded, usually narrower than widest part of elytra and often not projecting laterad (Fig. 36); EPI 106–121 (♂), 96–110 (♀).

Genitalia. Median lobe of aedeagus (Figs 113–117) × 0·5–0·6 as long as pronotum, × 1·9–2·3 as long as broad and very strongly arched; the cariniform sides in apical region unite across middle so that phallotreme lies in a deep, sharply defined, U-shaped depression; struts × 2·9–3·4 as long as median lobe; manubrium about as long as median lobe; flagellum *c.* × 0·7 as long. Spermatheca (Figs 123–125) varies little; gland small; duct × 2–3 overall length of spermatheca; spout straight, unpigmented; terminal chamber of bursa elongate.

Holotype ♂, PAPUA NEW GUINEA: Owen Stanley Range, Goilala, Tororo, 1560 m, 15–20.ii.1958 (*W. W. Brandt*), in BPBM.

Paratypes. PAPUA NEW GUINEA: 1 ♂, same data as holotype (BMNH); 3 ♀, Goilala, Bome, 1950 m, 24.ii–7.iii.1958 (*W. W. Brandt*) (2 BPBM, 1 BMNH); 1 ♀, same data except 16–31.iii.1958; 1 ♂, 1 ♀, ditto except 16–30.iv.1958 (all BPBM); 1 ♂, Goilala, 12 mls N. of Tapini, Perumeva, *c.* 4500 ft [1350 m], 14.vi.1962 (*Szent-Ivany, F. H. A. Kleckham & I. B. Pendergast*) (DAPM); 1 ♂, 2 ♀, Goilala, Metsialavava Pltn, 5000 ft [1500 m], 16.vi.1962 (*Szent-Ivany*) (2 DAPM, 1 BMNH); 1 ♂, 1 ♀, Morobe Dist., Garaina, 800 m, 16.i.1968 (*J. Sedlacek*); 1 ♀, Morobe Dist., Wau, 1200–1300 m, 22.x.1965 (*J. Sedlacek*) (both BPBM); 2 ♀, Wau, 1200 m, 23.ii.1966 (*J. Sedlacek*) (BPBM, BMNH); 1 ♀, Wau, 8.ix.1968 (*I. Loksa*) (TM); 1 ♀, Wau, Kujeru, 1500 m, 27.ix.1969 (*A. B. Mirza*); 1 ♀, Wau, Nami Creek, 1700 m, 17.v.1965 (*J. Sedlacek*) (both BPBM);

2 ♀, same data except 1700–1850 m and ii.1966 (BPBM, BMNH); 1 ♂, 2 ♀, Nami Creek, 22.viii.1968 (*J. Balogh*) (TM); 1 ♀, Wau, Mt Missim, 1600 m, 17.iii.1966 (*Gressitt*); 1 ♀, 'Missim 1.iii / 1650 m' [MS] (*J. & M. Sedlacek*) (both BPBM); 1 ♂, same locality, 22–24.iv.1965 (*J. Balogh & Szent-Ivany*) (TM).

Specimens examined: 28; dissected: 16 (8 ♂, 8 ♀).

Bionomic data. '[In] village garden, on *Phaseolus vulgaris* in dense popul[ation]' (Perumeva, S-I, *et al.*); 'Feeding on foliage of "Coffea arabica" ' (Metsialavava, S-I).

A wide-ranging species, distinguished only with difficulty from the following yet is itself highly variable, hence the name ('deceiver'). I have in this case chosen a dissected specimen as holotype to avoid any possibility of error.

Apirocalus (Apirocalus) insperatus sp. n.

(Figs 38, 39, 118–120; Map 4)

Range. Morobe District. Altitude: 1400–2350 m.

♂. Length 5·5–5·8 mm (2 specimens). Elytral processes acute, rising more steeply than in *A. fallax*; basal swellings indistinct (Figs 38, 39). Otherwise as in *A. fallax*.

Genitalia. Median lobe of aedeagus (Figs 118–120) ×0·54 and 0·57 as long as pronotum, ×2·28 as long as broad (single observation), moderately curved, apex weakly spatulate; struts ×2·74 as long as median lobe, manubrium ×0·9 as long (single observations); flagellum ×1·15 and 1·22 as long as median lobe, distinctly longer and stouter than in *A. fallax*.

Holotype ♂, Papua New Guinea: Morobe District, Mt Kaindi, 2350 m, 31.x.1966 (*G. A. Samuelson*), in BPBM.

Paratype. Papua New Guinea: 1 ♂, Morobe District, Wau, 1400 m, 17.vi.1961 (*J. Sedlacek*), in BMNH.

Both specimens have been dissected.

The smallest species of the nominate subgenus. Distinguished externally from *A. fallax* only by its larger and sharper elytral processes and smaller (average ?) size. The male genitalia are, however, unequivocally distinct; not only do the aedeagi differ markedly in shape but the flagellum in *A. insperatus* is longer than in *A. fallax* both relatively and in terms of actual length, although it is the smaller species (flagellum in *A. fallax* is 0·76 mm long and ×0·39 as long as pronotum; in *A. insperatus* it is 1·15 mm long and ×0·66 as long as pronotum).

The occurrence of two closely related species in the same locality is unusual and suggested the name of the present species ('unlooked-for'). If these species really do occur together, it may only be possible to recognize the female of *A. insperatus* by its longer spermathecal duct.

Apirocalus (Apirocalus) asper Marshall

(Figs 5, 81, 121, 122; Map 4)

Apirocalus asper Marshall, 1956 : 17, 20. Holotype ♀, Papua New Guinea (BMNH) [examined].

Range. Central District (near Tapini). Altitude: 1200 m.

Length 6·1–6·2 mm (2 specimens). Differs from *A. fallax* as follows. Tarsi not darker than tibiae; antennal club narrower on average (< ×2·8 as long as broad); scape thickening and widening apicad throughout, apex simple (not capitate), scales larger, setae on fore edge shorter, not exceeding greatest diameter of scape in middle of length; elytral striae less distinct, interstria 5 (in ♂) convex, forming a low carina, continuous with edge of fin; basal swellings distinct, lying entirely anterior to level of fin apices (not partly posterior to it); setae on elytra and legs smaller, linear or linear-lanceolate, those on elytra subrecumbent, mostly brown, the longest slightly longer than longest on scape; those on femora recumbent, pearly white, shorter than longest on scape. *Sexual dimorphism* very slight; ventrite 5 of ♂ with large fovea but sides rounded, not cariniform, as in *A. fallax*; ventrite 5 of ♀ with a small pre-apical fovea. Elytral processes angulate in both sexes, slightly larger in ♂ and wider than greatest width of elytra proper; processes in ♀ as wide as elytra; elytra in both sexes constricted at base of processes (cf. *A. fallax*); EPI 121 (♂); 114 (♀). Granulation of pronotum and elytra similar in both sexes.

Genitalia. Median lobe of aedeagus (Figs 121, 122) × 0·6 as long as pronotum, × 3·0 as long as broad, weakly arched, with a pair of sharp admedian carinae in basal third; struts × 3·0 as long as median lobe, manubrium about as long as median lobe, flagellum × 1·2 as long (all single observations); middle section of internal sac with dense field of pigmented claviform teeth (Fig. 81). Spermatheca, etc., not examined.

Holotype ♀, PAPUA NEW GUINEA: Central District, Mafulu, 4000 ft [1200 m], i.1934 (*L. E. Cheesman*), with 'Apirocalus/asper, Mshl./TYPE ♀' (Marshall MS), in BMNH.

Paratype. 1 ♂, same data as holotype except Marshall's label reads 'COTYPE ♀' (BMNH).

Two specimens; the holotype has been cleaned and remounted but not dissected.

Once again, the male genitalia provide the only certain means of recognizing this species. The flagellum is about as long as that of *A. insperatus*.

The *avus*-group

Elytral processes short and angular or long and blade-like, with or without a rounded swelling at base on meso-dorsal aspect. Surface of elytral disc ± even, granulate or not. Prothorax about as long as broad, slightly broader than long in some females and slightly longer than broad in some males; disc granulate or not. Antennal club × 0·3–0·4 as long as pronotum; scape slender, ± sinuous, apex weakly to distinctly capitate; setae on fore edge variable, usually stiff and semi-erect but pointed and seldom exceeding greatest diameter of scape in middle of length; funicle segments without any scales, hind tarsal segments 1 and 2 sometimes with one or two scales. Mesepisterna and arms of mesosternum both with scales. Median lobe of aedeagus × 2·0–2·6 as long as broad and × 0·45–0·60 as long as pronotum, weakly curved in profile view, without any carinae or other elevations on upper surface, apex broadly rounded; struts × 2·4–3·3 as long as median lobe and × 1·3–1·8 as long as pronotum; flagellum varying in length, × 0·7–3·3 as long as pronotum. Spermatheca ± linear, tail strongly reflexed, often larger than body; gland-lobe small, its axis making only a small angle with that of body (sometimes indistinct); gland small, linear or claviform; duct × 1·7–4·7 overall length of spermatheca. Styli of ovipositor × 3–4 as long as broad.

Differs from the *fallax*-group in that the prothorax is more evenly rounded at sides and more evenly convex on disc (if disc is flattened, this area is quite undefined); granules variable and often divided along mid-line but rarely with any trace of a median furrow; elytral processes, in general, larger and usually blade-like in ♂. The greatest contrast with the *fallax*-group lies, however, in the almost exact similarity of the median lobe of the aedeagus throughout the group, coupled with great variation in the length of the flagellum; flagellar length tends to increase from west to east across the range of the group. This trend is not, apparently, reflected in the external characters of the species, the relationships of which are obscure.

Apirocalus (Apirocalus) subcostatus sp. n.

(Figs 40–43, 126, 127, 134, 135; Map 3)

Range. Eastern Highlands. Altitude: 1500–2200 m.

Length 5·6–6·9 mm ($\bar{x}$ (11) = 6·0). Entirely reddish black, femora and tibiae often more distinctly red, tarsi concolorous or darker; scales pale brown with golden reflexion or grey or greenish grey. *Head* and *rostrum* as in *A. avus* except fewer scales on head capsule below eye. *Antennae* with funicle segments 1 and 2 equal and twice as long as broad, segments 3–5 subequal and × 1·1–1·3 as long as broad, segments 6 and 7 similarly proportioned but slightly larger; club × 2·1–2·6 as long as broad, ovate; scape as in *A. avus* except longest setae on fore edge sometimes exceeding greatest diameter of scape in middle of length. *Prothorax* as in *A. avus* but granulation of disc of pronotum more variable, largest granules sometimes well separated and only × 2 diameter of surrounding scales but sometimes × 3 diameter of scales and crowded irregularly together near mid-line which may be marked by traces of a narrow median furrow. *Elytra* as in *A. avus* except interstriae 3, 5 and 7 often ± raised from near their bases to bases of processes, strial setae brown (not pale) and those on fin edges in ♂ not longer than in ♀. *Mesepisterna* etc. as in *A. avus*. *Legs* as in *A. avus* except fore and middle tibiae very weakly incurved throughout their length. *Sexual dimorphism* moderate; spread of elytral processes in both sexes not exceeding greatest width of elytra proper and each with a distinct swelling on meso-dorsal aspect; processes in ♀ very short and turned strongly laterad, so inner sides face posteriad and are in a line or make a very obtuse angle with each other (Fig. 42); processes in ♂ somewhat longer, varying in shape but angle between their

inner sides < one and one-half right angles, outer edges well marked, subparallel (sometimes narrowed at base) (Fig. 40); EPI 119–130 (♂), 103–119 (♀). Ventrite 5 of ♂ with crater-like fovea (as in *A. fallax*); ♀ with much weaker fovea.

Genitalia. Aedeagus etc. (Figs 126, 127) as in *A. avus* except flagellum × 1·4 as long as pronotum (single observation, Goroka). Spermatheca (Figs 134, 135) usually more compact than in *A. avus*; duct × 2·3–2·5 overall length of spermatheca.

Holotype ♀, Papua New Guinea: Eastern Highlands, Mt Otto, 2200 m, 22.vi.1955 (*J. L. Gressitt*), in BPBM.

Paratypes. Papua New Guinea: 3 ♀, same data as holotype except 23.vi (2) and 24.vi (1) (2 BPBM, 1 BMNH); 1 ♀, Goroka, 1500 m, 23.v.1961 (*J. L. Gressitt*) with '3700' (MS) on separate label (BPBM); 1 ♂, same locality, G. Pentland's Pltn, 5200 ft [1560 m], iv.1955 (*Szent-Ivany*); 1 ♀, G. Greathead's Pltn, 7.iii.1961 (*J. H. Barrett*) (both DAPM); 1 ♂, 1 ♀, Asaro Valley, Miramar, 1800 m, 27.vi.1955 (*J. L. Gressitt*) (BPBM); 2 ♀, Okapa, Kamano, 28.i.1973 (*R. W. Hornabrook*) (RWH, BMNH); 2 ♂, Aiyura, 5400 ft [1620 m], 8 and 20.ii.1958 (*J. H. Barrett*) (DAPM, BMNH).

Specimens examined: 13; dissected: 7 (3 ♂, 4 ♀).

Bionomic data. 'Feeding on coffee foliage' (Goroka, S-1); 'x weeds' (G. Greathead's Pltn, JHB); '*G*[*revillea*] *robusta*' (Aiyura, JHB).

A very variable species; the raised interstriae, from which it takes its name, are strongly developed in some specimens but very weak in others.

Apirocalus (Apirocalus) avus sp. n.

(Figs 46–48, 50–55, 76, 128–131, 136–139; Map 3)

Range. Western, Southern and Eastern Highlands; Chimbu. Altitude: 1000–2700 m.

Length 5·1–7·7 mm. Black or reddish black, femora and tibiae usually distinctly red (tarsi darker); scale colour variable, brown, green, grey, pearly or coppery (paler on elytral declivity). *Head* and *rostrum* as in *A. fallax* except dorsal surface of rostrum less strongly narrowed behind antennal insertions and scales below eye extending on to head capsule. *Antennae* with funicle segments as in *A. fallax*; club × 2·1–2·9 as long as broad; scape as in *A. fallax* except scales not much smaller than those on pronotum and setae on leading edge often whitish, suberect and not exceeding greatest diameter of scape in middle of length, stouter and slightly shorter than those on funicle but ± finely pointed. *Prothorax* about as long as broad in ♀, similar to distinctly longer than broad in ♂, widest about middle, tapering more strongly to apex than to base (especially in ♂), without any pre-apical constriction; surface of disc of pronotum somewhat uneven, strongly and irregularly granulate, the largest granules near mid-line (and often divided along it by a clear space), their diameters < × 3 those of surrounding scales; scales ± contiguous throughout upper surface, larger and denser on sides, often imbricate below hind angles and on bulge above fore coxae; setae near sides < × 0·7 as long as those on leading edge of scape, those elsewhere inconspicuous. *Elytra* very broadly ovate (only slightly longer than broad in ♂), sides strongly and evenly rounded; disc flat in ♂, weakly convex in ♀, its surface even; striae clearly indicated by a row of bare punctures with, in front of each, a scale-sized bead-like granule, bearing on its posterior aspect a small pale seta which projects over the strial puncture but is shorter than the latter's diameter; interstriae 2–5 subequal in width, each with a single irregular row of very small granules, each bearing a blunt brown seta, about one-third (♂) to one-half (♀) as long as width of interstria in which it stands; setae near sides and on declivity longer, brown or white; edges of processes with fringe of soft, linear, finely pointed, pale brown or whitish setae, < × 2 as long as those on scape in ♀, < × 3 as long in ♂, usually pale in anterior part of fringe, grading to brown posteriorly; scales contiguous on upper surface and on fins, denser on sides, becoming imbricate in shoulder region and on declivity. *Mesepisterna* coarsely and irregularly punctured; arms of mesosternum, mesepisterna and mesepimera all with scales, either all similar (and similar to those on elytra) or those on mesepisterna smaller and/or duller, so that those on arms of mesosternum stand out as an isolated pale fleck. *Metasternum* and ventrites 1 and 2 ± densely squamose throughout and with very fine, pale, iridescent, erect or semi-erect setae; ventrite 5 with scattered smaller scales and smaller setae; ventrites 3 and 4 with a few small scales (in fresh specimens) and each with a single transverse row of setae. *Legs* with femora moderately swollen, ± straight (in side view) or with middle femora weakly curving dorsad; fore and middle tibiae very weakly incurved towards apex, hind tibiae straight; hind tarsal claw-segment × 1·9–2·3 as long as segment 3; scales on

exposed parts of femora and tibiae dense, those on widest part of femur larger, often imbricate and paler than rest; setae fine, curved, usually pointed, semi-erect, whitish, often with coloured reflexions, often arising from very small shiny granules; segments 1 and 2 of hind tarsi sometimes with one or two broad scales. *Sexual dimorphism* variable; elytral processes longer in ♂ than in ♀, their spread always exceeding greatest width of elytra proper, their inner margin swollen or not; processes of ♀ acute, their spread seldom exceeding greatest width of elytra proper.

Genitalia. Median lobe of aedeagus about half as long as pronotum, ×2·1–2·5 as long as broad; flagellum ×0·9–2·0 as long as pronotum. Spermatheca with duct ×2·0–3·4 its overall length.

Apirocalus (Apirocalus) avus avus subsp. n.

(Figs 52–55, 128, 129, 136, 137; Map 3)

Range. Eastern Highlands and Chimbu (Nomane). Altitude: 1500–2100 m.

Length, ♂: 5·4–7·4 mm ($\bar{x}$ (16) = 6·5); ♀: 6·0–7·7 mm ($\bar{x}$ (16) = 7·0). Prothorax about as long as broad in ♀, distinctly longer than broad in ♂; granules on disc of pronotum < ×2·5 diameter of surrounding scales. Setae near sides of elytra and on declivity at most about as long as those on leading edge of scape in ♀ but only one-half to two-thirds as long in ♂. *Sexual dimorphism* well marked; elytra of ♂ (Figs 52, 53) with well developed blade-like processes, tapering distad and with rounded apices, their lateral spread exceeding greatest width of elytra proper, distinctly rising from the horizontal but both lying in the same plane or only weakly tilted inwards, their inner sides straight or weakly sinuous but never with a distinct swelling, making a little more than a right angle with each other; outer third of blade compressed, forming a flange with well marked edge. Processes in ♀ (Figs 54, 55) shorter, not flattened, sharply angular, lateral spread not exceeding greatest width of elytra proper, their inner sides making about one and one-half right angles with each other (in antero-dorsal view) and their planes tilted inwards, making a right angle with each other (in posterior view); EPI 125–133 (♂), 112–122 (♀). Ventrite 5 of ♂ with crater-like fovea, that of ♀ simple.

Genitalia. Median lobe of aedeagus (Figs 128, 129) half as long as pronotum, ×2·1–2·4 as long as broad, weakly curved, apex ± evenly rounded; struts ×2·7–3·1 as long as median lobe, manubrium about as long as median lobe, flagellum ×2·4–2·6 as long and ×1·0–1·3 as long as pronotum, moderately curved throughout its length. Spermatheca (Figs 136, 137) with tail about as large as body; gland-lobe small but usually distinct, gland linear or claviform; duct-lobe elongate, variously flexed; duct about ×2·3 overall length of spermatheca; spout straight, sometimes pigmented.

Holotype ♂, Papua New Guinea: Eastern Highlands, Purosa, 1700 m, 17–25.v.1966 (*Gressitt & Tawi*), in BPBM.

Paratypes. Papua New Guinea: 29 ♂, 30 ♀, same data as holotype (49 BPBM, 10 BMNH); 4 ♂, 21 ♀, Purosa, 20–26 km SE. of Okapa, 1800–2020 m, 28.viii.1964 (*J. & M. Sedlacek*) (19 BPBM, 6 BMNH); 10 ♂, 18 ♀, Okapa, Purosa, 1700–2000 m, 18.i.1966 (*J. Sedlacek*) (26 BPBM, 2 BMNH); 1 ♀, Purosa, 2.xi.1964 (*R. W. Hornabrook*) (RWH); 3 ♂, 1 ♀, 24–26 km SE. of Okapa, 1800–1900 m, 25 and 27.viii.1964; 7 ♂, 8 ♀, 13 km SE. of Okapa, 1650–1870 m, 26.viii.1964 (all *J. & M. Sedlacek*) (all BPBM); 8 ♂, 8 ♀, Okapa, 1964–71 (various dates) (*R. W. Hornabrook*) (15 RWH, 1 BMNH); 2 ♂, 1 ♀, Okapa, *c.* 5000 ft [1500 m], Station No. 170, 4–15.ii.1965; 2 ♀, Wanitabe Valley, *c.* 5000 ft [1500 m], Station No. 174, 5.ii.1965 (all *M. E. Bacchus*) (all BMNH); 2 ♂, same locality, 11.x.1964; 1 ♂, Agakamatasa, 17.i.1965; 1 ♀, Konisitasa, 15.xi.1964 (all *R. W. Hornabrook*) (all RWH); 1 ♂, 1 ♀, Waisa, near Okapa, *c.* 5000 ft [1500 m], Station No. 193, 15.ii.1965 (*M. E. Bacchus*) (BMNH); 6 ♂, 9 ♀, Okapa, Okasa, 1400–1600(–1650) m, 16 and 17.i.1966 (*J. Sedlacek*) (13 BPBM, 2 BMNH); 2 ♂, 1 ♀, Moife, 15 km NW. of Okapa, 2100 m, 11–13.x.1959 (*T. C. Maa*) (BPBM); 1 ♀, Hegeturu [southern slopes of Mt Michael], 6700 ft [2010 m], 1962 (*L. B. Glick*) (BMNH); 1 ♂, Frigano [15 km E. of Lufa, 6200 ft [1860 m]], 15.vii.1972; 1 ♂, 3 ♀, Lufa, 1971–4 (various dates) (all *R. W. Hornabrook*) (4 RWH, 1 BMNH); 3 ♂, 2 ♀, 10 km NE. of Lufa, 1800–2100 m, 21.i.1966 (*J. & M. Sedlacek*) (4 BPBM, 1 BMNH); 1 ♂, 6 ♀, Arau, Gadsup, 12.ix.1972 (*R. W. Hornabrook*) (6 RWH, 1 BMNH); 1 ♂, 2 ♀, 20 km SW. of Kainantu, 1800 m, 16.i.1966 (*J. Sedlacek*); 1 ♂, 1 ♀, Kainantu, 1500 m, 20.i.1966 (*J. & M. Sedlacek*); 1 ♂, 2 ♀, Aiyura, 1800–1900 m, 6.i.1965; 1 ♀, Aiyura, 1700–1800 m, 9.i.1965 (all *J. Sedlacek*); 1 ♂, 1 ♀, same data except 5.i.1965 (♂) and (*J. L. Gressitt*) (both); 1 ♀, Kassem

Pass, 1400 m, 4.i.1965 (*J. & M. Sedlacek*) (all BPBM); 3 ♂, 2 ♀, Chimbu, Nomane, ix.1972 (*R. W. Hornabrook*) (4 RWH, 1 BMNH).

Specimens examined: 213; dissected: 16 (11 ♂, 5 ♀).

Apirocalus (Apirocalus) avus intermedius subsp. n.

(Figs 46, 47, 130, 131, 138, 139; Map 3)

Range. Western and Southern Highlands. Altitude: 1750–2700 m.

Length (5·1–)5·9–7·3 mm ($\bar{x}$ (20) = 6·6). Differs from the nominate subspecies as follows: scales on elytra sometimes coppery; antennal scape often widening ± evenly from near base to terminal swelling; club × 2·4–2·8 as long as broad, longer in ♂ than in ♀; prothorax slightly longer than broad in both sexes and largest granules on disc of pronotum < × 3 diameter of surrounding scales; elytra with larger granules along striae (on average); tarsi more often with scales: segments 1 and 2 of fore and middle tarsi sometimes with one or two scales on each, those of hind tarsi with up to four scales (in fresh specimens). *Sexual dimorphism* slight; elytral processes shorter in ♂ (Figs 46, 47) so ranges overlap: EPI 115–125 (♂), 112–119 (♀); ventrite 5 of ♂ ± distinctly foveate, that of ♀ simple or weakly foveate. Processes in ♂ strongly tapering, subacuminate, strongly diverging, with a ± well developed swelling on meso-dorsal aspect which imparts curvature to inner side, thus decreasing angle between bases (to about a right angle) while distal part of process appears to be reflexed laterad (in antero-dorsal view); spread usually distinctly exceeds greatest width of elytra proper. Processes in ♀ similar but shorter; angle between inner sides *c.* one and one-half right angles; spread about equal to greatest width of elytra proper.

Genitalia (Figs 130, 131, 138, 139) as in *A. a. avus* except flagellum longer, × 1·4–2·0 as long as pronotum (four observations), basal part strongly curved but not coiled into a ring; spermathecal duct × 2·0–3·4 overall length of spermatheca (three observations).

Holotype ♂, Papua New Guinea: Western Highlands, Yaibos, 2200–2150 m, 10.vi.1963 (*J. Sedlacek*), in BPBM.

Paratypes. Papua New Guinea: 1 ♂, 6 ♀, same data as holotype (5 BPBM, 2 BMNH); 1 ♀, Mt Hagen, 19.iii.1960 (*M. Levy*) (DAPM); 1 ♂, slopes of Mt Hagen, Tomba, 2450 m, 25.v.1963 (*J. Sedlacek*) (BPBM); 1 ♂, Tombi [Tomba], 7000 ft [2100 m], Lot No. 876, 3.vi.1974 (*J. N. L. Stibick*) (DAPM); 1 ♀, Baiyer River Sanctuary, 1–5.ix.1969 (*J. Balogh*) (TM); 1 ♀, 16 km NW. of Banz, 1700–2100 m, 28–29.vi.1963 (*J. Sedlacek*) (BPBM); 1 ♂, 2 ♀, Ahl Valley, Nondugl, 1750 m, 8.vii.1955 (*J. L. Gressitt*) (2 BPBM, 1 BMNH); 1 ♂, N[ondugl], 1.xi.[1950] [*W. W. Brandt*] (ANIC); 1 ♂, 1 ♀, Minj, 8–13.ix.1959 (*T. C. Maa*) (BPBM); 1 ♂, 1 ♀, Tambul, 9000 ft [2700 m], Lot No. 874 [vi.1974] (*J. N. L. Stibick*) (DAPM); 1 ♀, Kepilam, 2420–2540 m, 21.vi.1963 (*J. Sedlacek*) (BPBM); 2 ♂, 2 ♀, Kandep, 8000–8500 ft [2400–2550 m], 23.xii.1961–14.ii.1962 (*W. W. Brandt*) (3 ANIC, 1 BMNH); 1 ♂, 5 ♀, Southern Highlands, SE. of Mt Giluwe, Dimifa, 2200 m, 10, 11 and 12.x.1958 (*J. L. Gressitt*) (5 BPBM, 1 BMNH); 1 ♀, Rumpi, 14.x.1958 (*J. L. Gressitt*) (BPBM); 1 ♂, 1 ♀, Pangia, 17.vi.1975 (*R. W. Hornabrook*) (RWH).

Specimens examined: 35; dissected: 9 (6 ♂, 3 ♀). Females outnumber males by almost 2 : 1 in the above series.

This subspecies owes its name to the fact that it combines intermediate development of the elytral processes in the male with a flagellum of intermediate length.

Two females from the Jimi Valley (BPBM, ANIC) appear to belong to this subspecies but it would be desirable to check both sexes before extending the established range to include this area.

Apirocalus (Apirocalus) avus karimuicus subsp. n.

(Fig. 76; Map 3)

Range. Chimbu (Karimui). Altitude: 1000–1080 m.

Differs from the nominate subspecies in having a longer flagellum and broader prothorax in the male and a correspondingly longer spermathecal duct in the female. The figures are: flagellum × 1·5–1·8 as long as pronotum (five observations), basal part strongly curved but not forming a ring (Fig. 76); sperma-

thecal duct ×2·7 and 3·3 overall length of spermatheca; prothorax of ♂ ×0·97–1·04 as long as broad ($\bar{x}$ (15) = 1·01). The prothorax in fifteen males of the nominate subspecies (from Purosa) was ×1·04–1·17 as long as broad ($\bar{x}$ (15) = 1·08).

Holotype ♂, PAPUA NEW GUINEA: Chimbu, Karimui, 1080 m, 13.vii.1963 (*J. Sedlacek*), in BPBM.

Paratypes. PAPUA NEW GUINEA: 6 ♂, 8 ♀, same data as holotype (9 BPBM, 5 BMNH); 3 ♂, 3 ♀, ditto except other dates between 8 and 15.vii.1963; 4 ♂, 2 ♀, Karimui, 1000 m, 4, 5 and 8.vi.1961 (*J. L. & M. Gressitt*); 1 ♂, Karimui, 4.vi.1961 (*J. L. Gressitt*) (all BPBM); 4 ♂, 1 ♀, Karimui, 1000 m, v.1969 (*H. Ohlmus*) (TM).

Specimens examined: 33; dissected: 7 (5 ♂, 2 ♀).

Apirocalus (Apirocalus) avus finisterrae subsp. n.

(Fig. 48; Map 3)

Range. Finisterre Range. Altitude: 1000–2550 m.

Differs from the nominate subspecies in having a slightly shorter flagellum in the male (on average) and longer elytral processes in both sexes. The figures are: flagellum ×0·9–1·1 as long as pronotum (three observations); EPI 130–135 (♂); 117–129 (♀); processes of ♂ curving upwards and/or outwards; those of ♀ with spread exceeding greatest width of elytra proper (in one case (Fig. 48) closely resembling those of ♂ of nominate subspecies).

Holotype ♂, PAPUA NEW GUINEA: Finisterre Range, Wantoat, [1000 m], viii.1972 (*R. W. Hornabrook*), in BMNH.

Paratypes. PAPUA NEW GUINEA: 1 ♀, same data as holotype (RWH); 1 ♂, Moro, *c.* 5550 ft [1665 m], Station No. 78, 30.x–15.xi.1964 (*M. E. Bacchus*) (BMNH); 1 ♂, 1 ♀, Saidor, Matoko [1500 m], 6–24.ix.1958 (*W. W. Brandt*) (BPBM); 1 ♀, Komba (*Rev. L. Wagner*) (SAM).

Specimens examined: 6; dissected: 4 (3 ♂, 1 ♀).

Apirocalus (Apirocalus) avus marawakanus subsp. n.

(Figs 50, 51; Map 3)

Range. Eastern Highlands (Marawaka). Altitude: *c.* 1500 m.

Differs from the nominate subspecies in having a broader prothorax (as in subsp. *karimuicus*) and longer setae on the elytra (setae near sides as long as those on leading edge of scape in ♂, longer than this in ♀); spread of elytral processes of ♀ distinctly less than greatest width of elytra which are not, or only weakly, constricted at process bases (Fig. 51); processes of ♂ usually narrower than in nominate subspecies and elytra more strongly constricted at their bases (Fig. 50).

Holotype ♀, PAPUA NEW GUINEA: Eastern Highlands, Marawaka, vi.1974 (*R. W. Hornabrook*), in BMNH.

Paratypes. 1 ♂, 1 ♀, same data as holotype (RWH); 6 ♂, 1 ♀, ditto except v.1974 (4 RWH, 3 BMNH).

Specimens examined: 10; dissected: 3 (2 ♂, 1 ♀).

Bionomic data. 'In leaf litter.'

Two male specimens from Mt Piora (BPBM) may belong to this subspecies but have only very short setae on their elytra.

Apirocalus (Apirocalus) sedlaceki sp. n.

(Figs 6, 49, 132, 133, 140, 141, 245; Map 3)

Range. Morobe District. Altitude: 700–2400 m.

Length, ♂: 5·2–7·6 mm ($\bar{x}$ (22) = 6·4); ♀: 5·8–8·1 mm ($\bar{x}$ (21) = 6·9). Colour, scales, head, rostrum and antennae as in *A. avus*. *Prothorax* as long as broad in ♂ (Fig. 49), slightly broader than long (< 9 : 10) in ♀, usually strongly rounded at sides; otherwise as in *A. avus*. *Elytra* as in *A. avus* except setae near sides (in interstriae 6 and 7) longer, in ♂ as long as those on leading edge of scape, in ♀ usually slightly longer, suberect and conspicuous. *Sterna* and ventrites as in *A. avus* except contrast between smaller (dull) scales on mesepisterna and larger (bright) scales on arms of mesosternum is greater and more constant (Fig. 245). *Legs* as in *A. avus*. *Sexual dimorphism* well marked; elytral processes as in *A. avus* but more variable in shape in both sexes, those of ♀ with or without a swelling on meso-dorsal aspect; EPI 124–135(–144) (♂), 111–123 (♀).

Genitalia as in *A. avus* except flagellum about twice as long (× 2·3–2·7 as long as pronotum) and coiled into a ring which is incapable of being straightened; apex of median lobe of aedeagus often (but not always) subtruncate (Fig. 132) (evenly rounded in *A. avus*); spermathecal duct × 3·3–4·8 overall length of spermatheca.

Holotype ♂, Papua New Guinea: Morobe District, Wau, Nami Creek, 1700–1850 m, 7.ii.1966 (*J. & M. Sedlacek*), in BPBM.

Paratypes. Papua New Guinea: 12 ♂, 10 ♀, same data as holotype (16 BPBM, 6 BMNH); 9 ♂, 5 ♀, same data except ii.1966; 3 ♂, 3 ♀, ditto except 1700 m and 17 and 22.v.1965; 2 ♀, ditto except 1700–1800 m and 17.xi and xii.1965; 8 ♂, 4 ♀, Nami Creek, 6 km W. of Wau, 1700 m, 12 and 15.vi.1962 (all *J. Sedlacek*) (all BPBM); 8 ♂, 7 ♀, Nami Creek, 22.viii.1968; 6 ♂, 1 ♀, Wau, Mt Kaindi, 24–25.viii.1968, 19–24.viii and 24.ix.1969 (all *J. Balogh*) (all TM); 39 ♂, 26 ♀, Mt Kaindi, 1500–2400 m, 1962–1969 (various dates) (*Sedlacek(s)*, *Gressitt(s)*, *G. A. Samuelson*) (61 BPBM, 4 BMNH); 2 ♂, Mt Kaindi, *c.* 8000 ft [2400 m], 16.iv.1965 (*Szent-Ivany*); 1 ♂, Mt Kaindi, *c.* 6000 ft [1800 m], 16.ii.1966 (*Rhonda M. Stevens & A. Fischle*) (all DAPM); 2 ♀, Mt Kaindi, 18.i.1970 (*F. R. Wylie*) (DFB); 26 ♂, 20 ♀, Wau, Edie Creek, 1700–2300 m, 1961–1966 (various dates) (*Sedlacek(s)*, *J. L. Gressitt*, *G. A. Samuelson*, *P. Shanahan*) (45 BPBM, 1 BMNH); 3 ♂, 2 ♀, Edie Creek, 7000 ft [2100 m], Station Nos. 6 and 19, 17 and 21.ix.1964; 3 ♀, Edie Creek, Bulldog Road, 9700 ft [2910 m], Station No. 13, 20.ix.1964 (all *M. E. Bacchus*) (all BMNH); 1 ♂, 2 ♀, Bulldog Road, 40 km S. of Wau, 2100–2800 m, 22–30.iv and 22–31.v.1969 (*Sedlaceks*); 1 ♂, Bulldog Road, 60 km S. of Wau, 2170 m, 1–7.v.1969 (*J. Sedlacek*); 1 ♂, Lake Trist, 1600 m, 21–26.xi.1966 (*G. A. Samuelson*); 9 ♂, 14 ♀, Wau, Big Wau Creek, 1200 and 1300 m, ix and xii.1965 (*P. Shanahan*); 4 ♂, 4 ♀, Big Wau Creek, 1300 m, 3.ii.1966 ; 1 ♂, 3 ♀, Wau Creek, 1100–1500 m, 28.iii and 6.v.1963 and 6.x.1965 (*J. Sedlacek*) (all BPBM); 1 ♂, 2 ♀, Wau Creek (no other data) (SAM); 1 ♂, head of Wau Creek, 5000 m [*sic*], 19.ix.1962 (*H. W. Clissold*); 5 ♂, 2 ♀, Wau, Kunai Creek, 1200–1250 m, 28.v.1964 and 15 and 28.v.1965 (*J. Sedlacek*); 10 ♂, 9 ♀, Wau, Hospital Creek, 1150–1300 m, 1965–1966 (various dates) (*Sedlacek(s)*, *P. Shanahan*); 1 ♂, Wau, Kujeru, 1500 m, 27.ix.1969 (*A. B. Mirza*); 1 ♂, Kilolo Creek, 7 km W. of Wau, 1070 m, 15–25.viii.1967 (*Tawi*) (all BPBM); 1 ♂, Kilolo Creek, 26.viii.1968 (*I. Loksa*); 7 ♂, Wau, McAdam Park, 18–21.iv.1965 (*J. Balogh and Szent-Ivany*); 1 ♂, McAdam Park, ix.1968 (*I. Loksa*) (all TM); 1 ♂, 1 ♀, McAdam Park, 1200–1300 m, 7.v.1965 (*J. Sedlacek*) (BPBM); 2 ♂, McAdam Park, 1200 m, 23.iv.1970; 2 ♂, Wau, Shanahan Pltn, 1200 m, 27.iv.1970 (all *J. N. L. Stibick*) (all CWO'B); 2 ♂, 1 ♀, Wau, Coviak Ridge, 763 m, 7.xii.1963 (*H. C*[*lissold*]); 1 ♀, 24–32 km SE. of Wau, 1500–1900 m, 20.iii.1962 (*J. Sedlacek*) (all BPBM); 4 ♂, 1 ♀, Wau, Bishop Museum Field Station, 15–25.iv.1965 (*J. Balogh & Szent-Ivany*); 2 ♀, Wau, 21–23.viii.1968 and 30.ix.1969 (*J. Balogh*) (all TM); 155 ♂, 205 ♀, Wau, 1000–1700 m, 1961–1969 (various dates and collectors) (335 BPBM, 25 BMNH); 1 ♂, 4 ♀, Wau, 15.ii.1966 (*Rhonda M. Stevens*) (DAPM); 2 ♂, 2 ♀, U[pper] Watut SW, 1100–2000 m, 30.iv.1968 (*J. L. Gressitt*); 1 ♀, Watut River, 900–1900 m, x.1959; 1 ♀, Upper Vatut [*sic*] River, 24 km W. of Bulolo, 760 m, 5–6.iii.1963 (both *J. Sedlacek*); 3 ♂, 3 ♀, Arabuka, 15[00]–2000 m, 7.i.1968 (*Sedlaceks*); 2 ♂, 1 ♀, Bulolo River, 1300 m, 17.ix.1969 (*A. B. Mirza*); 1 ♂, 3 ♀, Bulolo River, 800–1100 m, 21.vii, 24.viii and 25.ix.1965 (*E. J. Ford, Jr*); 1 ♂, 1 ♀, Bulolo, 700 m, 26.xi.1969 and 9.xi.1962 (*Sedlaceks*); 4 ♂, 5 ♀, Mt Missim, 950–2000 m, 1963–1966 (various dates and collectors) (all BPBM); 1 ♂, 2 ♀, Mt Missim (*Stevens*) (MCZ); 17 ♂, 8 ♀, Haus Copper, Wau, Mt Missim, 22–24.iv.1965 (*J. Balogh & Szent-Ivany*) (21 TM, 4 BMNH); 1 ♂, 1 ♀, Kuper Range, 700–1700 m, 24.i.1969 (*J. Sedlacek*) (BPBM); 1 ♂, 1 ♀, Morobe District, near Bainding Village [17 km NE. of Bulolo], *c.* 3000 ft [900 m],

14.iii.1967 (*T. L. Fenner & M. H[engeveld]*) (DAPM); 2 ♂, Asiki [Aseki] [60 km W. of Wau], 2000 m, xi.1972 (*J. Sedlacek, Reni*) (CWO'B).

Specimens examined: 730; dissected: 26 (17 ♂, 9 ♀).

A record for Garaina (BPBM) requires confirmation.

Bionomic data. 'On *Pipturus* sp.' (Mt Kaindi, FRW); 'Grasses' (Wau, JLG); 'In rainforest' (Bainding, TLF).

This species shows considerable variation in the shape of both the pronotum and the elytral processes. Specimens of either sex with a narrow pronotum closely resemble *A. avus*, while such females with swollen elytral processes resemble *A. intermedius*; males with normal pronotum but slender elytral processes can scarcely be distinguished (externally) from *A. avus finisterrae*. This species also occurs over an unusually wide range of altitude. Specimens from over 2500 m are above average size and the elytral processes of the males are abnormally long (EPI 134–144). The accompanying females have normal EPI's but the elytra are not narrowed before the process bases and the pronotum is as long as broad ($\times 0{\cdot}98$–$1{\cdot}04$; $\bar{x}$ (6) = 1·00).

Apirocalus (Apirocalus) suppuratus sp. n.

(Figs 44, 45, 142; Map 3)

[*Apirocaulus* (*sic*) *cornutus* Pascoe; Anonymous, 1965 : 109. Misidentification.]

Range. Owen Stanley Range (Woitape). Altitude: 1500–1800 m.

Length, ♂: 5·9–6·6 mm ($\bar{x}$ (18) = 6·2); ♀: (5·6–)6·2–7·3 mm ($\bar{x}$ (11) = 6·7). Black or reddish black, legs often more distinctly red (tarsi darker); scales pale brown or coppery, often with strong metallic reflexions (when clean). *Head* and *rostrum* as in *A. avus* except eyes less strongly convex and median rostral carina often (especially in ♀) very broad and flat, tapering posteriad and with a narrow median sulcus anteriorly. *Antennae* with funicle segments 1 and 2 $\times 2{\cdot}0$–$2{\cdot}5$ as long as broad, 2 usually slightly longer than 1; segments 3–5 $\times 0{\cdot}6$ as long as 2 and $\times 1{\cdot}3$–$1{\cdot}4$ as long as broad in ♂, $\times 0{\cdot}9$–$1{\cdot}3$ as long in ♀; segments 6 and 7 of similar proportions but slightly larger (on average); club $\times 2{\cdot}2$–$2{\cdot}8$ as long as broad, ovoid; scape as in *A. fallax* except setae on leading edge suberect, finely pointed, brown and white and seldom exceeding greatest diameter of scape in middle of length; funicle segments all with very fine recumbent silky hairs, larger and paler (hence more conspicuous) on segments 1 and 2. *Prothorax* as long as broad or very slightly longer ($< \times 1{\cdot}04$), widest about middle, sides evenly and moderately rounded, apex distinctly narrower than base; upper surface as in *A. avus* but usually with fewer, smaller granules (sometimes no larger than surrounding scales). *Elytra* as long as broad in both sexes, strongly and evenly rounded from base but only very slightly constricted before process bases; disc weakly convex, surface even or faintly rugose or with interstria 5 feebly raised; strial punctures largely obscured by scales, their associated granules (see *A. avus*) very small, often only half diameter of surrounding scales; interstrial granules smaller still; setae near sides and on declivity similar to those on leading edge of scape, those in process fringes up to twice as long, pearly white anteriorly, red-brown posteriorly (in various proportions); scales imbricate on upper part of sides and on declivity, elsewhere contiguous or subcontiguous. *Sterna* and venter as in *A. avus*. *Legs* as in *A. avus* except setae on femora a little stouter, whiter and subrecumbent. *Sexual dimorphism* slight; elytral processes in both sexes short, angular and each with a gross, abscess-like swelling on meso-dorsal aspect; those of ♂ (Figs 44, 45) usually wider than elytra proper, more flattened and with rounded apices; those of ♀ sharper, their outer sides subparallel or converging, usually (but not always) narrower than elytra proper; EPI 114–120 (♂), 100–116 (♀); ventrite 5 weakly or indistinctly foveate in both sexes, more broadly rounded in male; segments 3–5 of antennal funicle quadrate in ♀, longer than broad in ♂ (see above).

Genitalia as in *A. avus* except flagellum about three times as long ($\times 3{\cdot}0$–$3{\cdot}3$ as long as pronotum) and coiled into a ring as in *A. sedlaceki*; spermathecal duct correspondingly long, $\times 4{\cdot}7$–$5{\cdot}3$ overall length of spermatheca (three observations).

Holotype ♀, Papua New Guinea: [Owen Stanley Range], Goilala, Woitape, Iemi No. 2 village garden, *c.* 6000 ft [1800 m], 21.viii.1963 (*Szent-Ivany et al.*), B.M. 1963–672, in BMNH.

Paratypes. Papua New Guinea: 1 ♂, 6 ♀, same data as holotype (BMNH); 28 ♂, 13 ♀, same locality, 7.viii.1963 (*Szent-Ivany, I. Pendergast & A. Fauma*) (34 DAPM, 7 BMNH); 2 ♂, Iemi No. 1 village gardens, 6000 ft [1800 m], 22.viii.1963 (*Szent-Ivany*); 1 ♂, 1 ♀, Yemi [*sic*] village, 14.x.1963 (*L. Smee*); 3 ♀, Woitape, native garden, 14.16 [x].1963 (*L. Smee*); 1 ♂, 1 ♀, Woitape,

5000 ft [1500 m], 3.ix.1963 (*Szent-Ivany*) (all DAPM); 1 ♂, 1 ♀, Woitape, 1500–1750 m, 2–3.xi.1965 (*J. Sedlacek*) (BPBM); 1 ♀, Woitape, Kosipe, iv.1969, A. C. Allyn coll. (FMNH).

Specimens examined: 61; dissected: 10 (5 ♂, 5 ♀).

Bionomic data. 'On *Solanum*' and 'On *Solanum tuberosum* in dense population' (Iemi villages, S-I); 'Feeding on *Coffea arabica*' (Woitape, S-I).

A distinctive species (small males may, however, resemble male of *A. subcostatus*), presently known from a very restricted area. A record for Brown River (DAPM) requires confirmation.

Apirocalus (Apirocalus) canus sp. n.

(Fig. 143; Map 3)

Range. Owen Stanley Range (western end). Altitude: 900–2200 m.

Length, ♂: 6·1–7·4 mm ($\bar{x}$ (20) = 6·7); ♀: 6·3–8·2 mm ($\bar{x}$ (20) = 7·0). Black or reddish black, legs and antennae reddish black; scales mainly pale brown (rarely greenish); setae mainly white or hyaline (including those on antennal funicle). *Head* and *rostrum* as in *A. avus* except median rostral carina usually ill-defined or indistinct. *Antennae* with proportions of funicle segments and club as in *A. fallax*; scape as in *A. avus* but varying in both shape and width and strongly thickening in apical third; setae on leading edge white, often blunt, ± strongly curved, semi-erect; setae elsewhere smaller (on average) and less strongly raised, often all white but sometimes a few recumbent brown ones along middle of upper surface (very inconspicuous); recumbent silky hairs present on all funicle segments (larger and denser than in *A. avus*). *Prothorax* as long as or slightly longer than broad (< × 1·08 as long in ♂), widest in, or slightly in front of middle, tapering more strongly to apex than to base; granules on disc of pronotum < × 4 diameter of surrounding scales, sometimes divided along mid-line by a clear space; otherwise as in *A. avus*. *Elytra* as in *A. avus* except surface usually with weak irregular transverse rugae and strial granules usually larger than surrounding scales (< × 2·3 their diameter); setae near sides white, recumbent and inconspicuous; setae in process fringes < × 3–4 as long as those on leading edge of scape (in both sexes), mainly white; scales subcontiguous on disc, not concealing integument completely, becoming imbricate (and sometimes paler) along interstria 7 and on declivity. *Mesepisterna* coarsely punctured and arms of mesosternum smooth (as in the other species) but scales, when present, always few, dull brown and smaller than those on elytra (not forming a pale fleck on arms of mesosternum). *Metasternum* and venter as in *A. avus*. *Legs* with femora as in *A. avus*; fore tibiae weakly incurved towards apex, middle tibiae weakly incurved throughout, hind tibiae straight; scales on femora usually uniform, subcontiguous; setae fine but blunt, white and subrecumbent; segments 1 and 2 of hind tarsi sometimes with 1–4 small pearly scales. *Sexual dimorphism* not well marked; elytral processes of ♂ similar to those of *A. avus*; those of ♀ shorter and with their planes tilted more strongly inwards but similar in shape and with similar apical fringe of setae; EPI 125–133 (♂); 118–126 (♀); ventrite 5 simple in both sexes.

Genitalia as in *A. avus* except flagellum about three times as long (× 3·1–3·3 as long as pronotum) and coiled into a ring as in *A. sedlaceki* and *A. suppuratus*; spermatheca (Fig. 143) as in *A. sedlaceki* but relatively larger, hence, although duct is only × 3·7–4·5 overall length of spermatheca (within range of *A. sedlaceki*), it is in fact longer – *A. sedlaceki*: 2·4–3·1 mm; *A. canus*: 3·3–4·5 mm.

Holotype ♂, Papua New Guinea: Owen Stanley Range, Goilala, Bome, 1950 m, 8–15.iii.1958 (*W. W. Brandt*), in BPBM.

Paratypes. Papua New Guinea: 11 ♂, 11 ♀, same locality as holotype (17 BPBM, 5 BMNH); 3 ♂, 6 ♀, ditto except 24.ii–7.iii.1958 (7 BPBM, 2 BMNH); 1 ♂, ditto except 16–30.iv.1958 (BPBM); 7 ♂, 5 ♀, Goilala, Tororo, 1560 m, 15–20 and 21–24.ii.1958 (*W. W. Brandt*) (10 BPBM, 2 BMNH); 1 ♀, Goilala, Loloipa, 1–15.ii.1958; 1 ♂, 1 ♀, Goilala, Tapini, 975 m, 16–25.xi.1957 (all *W. W. Brandt*); 1 ♀, Tapini, 1000 m, 9–12.vii.1968; 3 ♀, Mt St Mary, 1900 m, 8–14 and 15–21.vii.1968 (all *Mena*); 1 ♀, Iongai, 10 km E. of Mt Albert Edward, 1450 m, 7.xi.1965; 1 ♀, Iongai, 1700–1900 m, 9.xi.1965 (both *J. Sedlacek*) (all BPBM); 1 ♂, 3 ♀, Goilala, Metsialavava Pltn, 5000 ft [1500 m], 16.vi.1962; 1 ♀, Goilala, Perumeva, 12 ml [19 km] N. of Tapini, village garden, 4500 ft [1350 m], 14.vi.1962 (both *Szent-Ivany*); 1 ♀, ditto except (*Szent-Ivany, F. H. A. Kleckham & I. B. Pendergast*); 2 ♂, Kamulai, 50 ml [80 km] NNW. of Tapini, 2200 m (no further data) (all DAPM); 3 ♂, 4 ♀ [Tapini], Mafulu, 4000 ft [1200 m], i.1934; 1 ♂ [Tapini], Mondo, 5000 ft [1500 m], i–ii.1934; 1 ♀ [Kokoda, near The Gap], Orrori, 3000 ft [900 m], vii.1933; 1 ♀ [Kokoda ?], Oquali, 4000 ft [1200 m], vii.1933 (all *L. E. Cheesman*) (all BMNH).

Specimens examined: 72; dissected: 6 (3 ♂, 3 ♀).

Bionomic data. 'On sweet potato' and 'Feeding on leaves of "Coffea arabica" ' (Metsialavava, S-I); 'On pumpkin' (Perumeva, S-I); 'On *Phaseolus vulgaris* in dense population' (Perumeva, S-I *et al.*).

The combination of prominent bead-like granules on the elytral striae with the predominance of white setae on the antennal scape and the lack of a pale fleck on the arms of the mesosternum distinguish this species from its relatives. In addition, the median rostral carina is often (though not always) virtually absent and the granules on the pronotum are, on average, larger than in the other species of the group.

The *granulicollis*-group

Apirocalus (Apirocalus) granulicollis sp. n.

(Figs 144–146, 239, 240; Map 3)

Range. Morobe District (Saruwaged Range). Altitude: 1350–1920 m.

Length 7·5–8·8 mm. Head and body black, femora, tibiae and antennal funicle black or reddish black; scales on pronotum and elytra partly, sometimes predominantly, pale green; elsewhere mainly pearly with coppery reflexion. *Head* and *rostrum* as in *A. avus* but relatively wider, eyes more widely separated (on average) and dorsal surface of rostrum broader, flatter and more distinctly expanded over scrobes; median rostral carina distinct but often abbreviated posteriorly. *Antennae* with funicle segments 1 and 2 subequal and × 2·0–2·5 as long as broad; segments 3–7 subequal, × 1·5–2·0 as long as 2 and × 1·1–1·7 as long as broad (5 shortest, 7 longest); club × 2·7–3·1 as long as broad, fusiform; scape almost straight, widening slightly from base to near apex, thickening in apical third and with a weak pre-apical constriction on leading edge only (subcapitate); sculpture as in *A. fallax*; setae on leading edge brown or pearly white, moderately curved, semi-erect, blunt-tipped, shorter than greatest diameter of scape in middle of length; funicle segments with recumbent silky hairs. *Prothorax* as long as broad, widest in or in front of middle; sides there strongly rounded, tapering ± evenly to base, more strongly to apex and with a ± distinct pre-apical constriction; upper surface with round shiny bead-like granules, more numerous and more regularly spaced than in *A. avus* and not divided along mid-line, the largest × 3–4 diameter of surrounding scales; scales contiguous between granules, much larger and imbricate on upper part of sides; setae near sides smaller than those on leading edge of scape, recumbent and inconspicuous. *Elytra* ovate, *c.* × 1·2 as long as broad, declivity almost vertical, disc almost flat transversely, weakly convex in profile view; surface even, or with faint transverse rugae; strial punctures small and ill-defined but mostly not concealed by scales and with large associated granules (< × 2 diameter of scales) as in *A. canus*; each interstria with a single rather irregular row of much smaller (< scale-size) granules, each bearing a blunt, brown or white seta, its length equal to one-third to half width of interstria, even near sides (cf. *A. avus*); setae in process fringes × 3 as long as those on scape, pearly white, grading to red-brown at apex; scales contiguous along interstriae on disc, imbricate on interstriae 7 and 8 but sparse on sides below processes and near costal margin; scales on meso-dorsal aspect of processes (and on intervening part of declivity) small and brown, forming a sombre transverse band which, in clean specimens, contrasts with bright scales further down declivity. *Mesepisterna* coarsely and irregularly punctured and with a few small scales at posterior end; arms of mesosternum smooth and with a ± extensive patch of large, bright, pearly scales which therefore stand out as an isolated pale fleck (as in *A. sedlaceki*, etc.). *Metasternum* and venter as in *A. avus* except ventrites 3 and 4 with setae irregularly disposed (not forming a single transverse row on each). *Legs* stouter than in *A. avus*; femora more strongly swollen; fore tibiae strongly incurved towards apex, middle tibiae moderately incurved, hind tibiae straight or very weakly incurved towards apex; hind tarsal claw-segment about twice as long as segment 3; scales as in *A. avus*; setae mainly white or hyaline, those on femora blunt, weakly curved and subrecumbent; those on tibiae finely pointed, weakly curved and suberect on inner (ventral) aspect becoming shorter, blunt, strongly curved and recumbent on outer (dorsal) aspect; no scales observed on tarsi. *Sexual dimorphism* well marked; elytral processes of ♂ similar to those of *A. avus* (♂) except elytra not, or very little, narrowed at fin bases (Fig. 239); processes of ♀ variable, well developed and with marginal fringe as in ♂ but strictly horizontal, their outer sides subparallel or curving mesad (narrower than greatest width of elytra proper), their inner sides either straight, simple, making an acute angle or each with a gross, elongate swelling which may reach almost to apex and impart a U-shape to space between processes (Fig. 240); EPI 144 (♂), 139–143 (♀); ventrite 5 of ♂ with pair of ill-defined longitudinal carinae (clearly derived from crater-like fovea of related species); carinae present, but less well developed, in ♀.

Genitalia. Median lobe of aedeagus (Figs 144, 145) similar to that of *A. avus*, ×0·6 as long as pronotum and ×2·6 as long as broad; struts ×2·4 as long as median lobe, manubrium as long as median lobe, flagellum ×1·3 as long and ×0·7 as long as pronotum, moderately curved throughout its length. Spermatheca (Fig. 146) with additional, blind, lobe opposite gland lobe; tail cylindrical (not tapering), apex bluntly rounded; duct ×1·9 overall length of spermatheca.

Holotype ♀, PAPUA NEW GUINEA: Morobe District, Salawaket [=Saruwaged] Range, Baindoang [Baindoung], 1800 m, 15.ix.1956 (*E. J. Ford, Jr*), in BPBM.

Paratypes. PAPUA NEW GUINEA: 1 ♀, same data as holotype (BMNH); 2 ♂, Salawaket Range, Sepalakambang [Seperagambang], 1920 m, 11.ix.1966 (*E. J. Ford, Jr*) (BPBM, BMNH); 1 ♀, Salawaket Range, Tuwep [Tewep], 1350 m, 8.ix.1956 (*E. J. Ford, Jr*) (BPBM).

Specimens examined: 5; dissected: 3 (1 ♂, 2 ♀).

Distinguished from the *avus*-group by the well developed and swept-back elytral processes of the female; the male somewhat resembles the male of *A. sedlaceki* but is larger and has more elongate elytra. The prominent granules on the pronotum and elytra, the green scales and the fact that it occurs in the Saruwaged Range, suggest an affinity with the *nivosus*-group. The additional lobe of the spermatheca is unique.

The *nivosus*-group

Elytral processes usually well developed but their spread less than, to only slightly greater than, greatest width of elytra proper. Antennal scape flattened, ± straight, apex simple or subcapitate; setae on fore edge suberect, distinctly shorter than greatest diameter of scape in middle of length; funicle with pale setae but no scales; club *c.* ×0·3 as long as pronotum. Upper surface of prothorax usually strongly and uniformly granulate; disc sometimes depressed and with traces of a narrow median carina. Surface of elytra usually shagreened or microreticulate, matt. Scales, in part, green (sometimes glittering) but body often with extensive areas of whitish and/or brownish scales; mesepisterna covered with scales; tibiae with scales scattered or at most subcontiguous, even on outer (dorsal) aspect; segment 2 of hind tarsi sometimes with a few small scales. Setae throughout very fine and stiff. Females larger than males and apparently less numerous. Ventrite 5 simple in ♀, very weakly foveate in ♂. Median lobe of aedeagus simple, ×3 as long as broad and ×0·5–0·7 as long as pronotum, apex acuminate; struts ×2·2–2·7 as long as median lobe; manubrium slightly shorter than median lobe; flagellum very long, ×3·5–5·1 as long as pronotum. Spermatheca compact, tail usually smaller than body, tapering; gland-lobe obsolete; gland claviform or pedunculate; duct-lobe small; styli of ovipositor ×4·0–5·5 as long as broad.

Though of uncertain affinities within *Apirocalus*, the slender form, green scales, fine erect setae and, in some cases, the pronotal carina, long scape and long second tarsal segment of this group all show an affinity with the genus *Hellerrhinus*. All three species are new and occur in the Finisterre–Saruwaged Ranges.

Apirocalus (Apirocalus) nivosus sp. n.

(Figs 7, 147, 153, 234; Map 4)

Range. Huon Peninsula. Altitude: 750–2550 m.

Length, ♂: 7·4–8·7 mm; ♀: 9·3 mm. Black; antennal funicle, trochanters, femora and tibiae dark red; scales generally imbricate, green or brownish with extensive ill-defined pale areas on pronotum and elytra (notably on disc and declivity); head and rostrum usually with mainly pearly scales which contrast sharply with greenish scales of prothorax. *Head* with frons gently declivous, sometimes with traces of a short median carina; surface rugulose, with larger rugae at sides, encircling eyes; eyes larger and more strongly convex than in *A. ebrius*; scales imbricate, either all pearly or with ill-defined admedian patches of dull green; large ovate pearly scales extending on to head capsule behind and below eyes. *Rostrum* tapering evenly from base, widening again at genae; upper surface flat or depressed, sides sinuous, with a well defined smooth median carina, at least in anterior half; sides of pterygia and upper surface with large imbricate scales, usually pearly but partly green when those on frons are green. *Antennae* with funicle segments 4–7 subequal and distinctly longer than broad, 3 slightly longer, 1 and 2 almost twice as long and about twice as long as broad; club ×2·3–2·7 as long as broad; scape widening and thickening ±

evenly in distal two-thirds; upper surface with longitudinal rugulae which are mostly covered with scales; setae resembling those on funicle, fine, stiff, weakly curved, usually suberect on leading edge, semi-erect (and equally numerous) on upper surface, less strongly raised elsewhere, those on underside white, remainder mostly brown. *Prothorax* as long as broad in ♀, slightly longer than broad in ♂, widest in, or slightly in front of, middle, evenly tapering or weakly rounded basad, strongly rounded apicad; dorsal surface strongly convex in anterior half, its outline in profile view closely resembling that of sides in dorsal view, disc without any depression or median carina; dorsal surface and much of sides with well separated, well defined, shiny bead-like setiferous granules which project through a solid incrustation of imbricate scales, mostly greenish but often with very ill-defined paler areas above sides; surface between granules shagreened; setae similar to those on scape but smaller. *Elytra* narrowly ovate, × 1·3–1·4 as long as broad, sides weakly rounded; disc weakly to strongly depressed in ♂, weakly transversely convex in ♀; strial punctures obscured by scales; strial granules very small along stria 1 (about as large as surrounding scales), becoming larger in striae 2 and 3 and much larger in 4–6 (each granule with a minute pale seta arising from posterior aspect); interstrial granules smaller and fewer but each bearing a large, dark, fine, stiff, erect or suberect seta; elytral processes of ♂ elongate, terete, isodiametric or weakly compressed, rising steeply from posterior third of elytra and not, or weakly, diverging (spread only about two-thirds greatest width of elytra proper), without edges but with usual fringe of long setae at apex; processes of ♀ more strongly compressed, tapering and diverging than those of ♂; EPI 140–148 (♂), 130 (♀); scales as on prothorax, pale on disc (and anterior aspect of processes), declivity and costal margin; setae suberect, almost straight, the longest longer than those on scape. *Mesepisterna* covered with scales similar to those on elytra and with a few very small inconspicuous setae; arms of mesosternum ± covered with large and small scales and without any setae; mesepimera ± covered with small scales. *Metasternum* and venter with ± contiguous thin bluish white scales, those on metasternum and ventrite 1 as large as those on elytra (becoming greenish at sides), on ventrite 2 somewhat smaller, on ventrites 3–5 much smaller and separate; setae semi-erect, very fine, soft and mostly pale. *Legs* with femora moderately swollen; fore and middle tibiae very weakly incurved towards apex, hind tibiae straight; hind tarsal claw-segment × 1·9–2·1 as long as segment 3; scales greenish white or pearly with coppery reflexion, usually smaller than those on elytra, subcontiguous throughout femora and along outer (dorsal) edge of tibiae; setae very fine, mostly semi-erect, pale brown or whitish.

Genitalia. Median lobe of aedeagus (Fig. 147) two-thirds as long as pronotum and about three times as long as broad; struts × 2·2–2·4 as long as median lobe, flagellum × 7·5–7·7 as long and × 4·8–5·1 as long as pronotum (three observations), basal part curled into a ring. Spermatheca (Fig. 153) described above (p. 226).

Holotype ♂, Papua New Guinea: Morobe District, Huon Peninsula, Kalalo, 750 m, 20–30.viii.1966 (*G. A. Samuelson & Mena*), in BPBM.

Paratypes. Papua New Guinea: 2 ♂, 1 ♀, same data as holotype (2 BPBM, 1 BMNH); 2 ♂, east end of Saruwaged Range, 20 km SSW. of Kabwum, 2550 m, 5–12.viii.1966 (*G. A. Samuelson*) (BPBM, BMNH); 1 ♂, Eastern Highlands, Mt Piora, 6° 45′ S, 146° E, 2100 m, 12.vi.1966 (*J. L. Gressitt*) (BPBM).

Specimens examined: 7; dissected: 4 (3 ♂, 1 ♀).

The distinctive elytral processes of this species (Fig. 234) somewhat resemble those of *A.* (*Molobrium*) *gracilis* but the seta-fringes at their apex show clearly its affinity with the nominate subgenus. The extensive pale areas on the elytra give this species a pruinose or frosted appearance. The record for Mt Piora is unexpected and requires confirmation.

Apirocalus (Apirocalus) atrigenua sp. n.

(Figs 148, 152, 235, 236; Map 4)

Range. Madang District (Finisterre Range). Altitude: 2550 m.

Length, ♂: 8·2–9·2 mm; ♀: 9·9 mm. Head, body, antennal scape, coxae and tarsi black; antennal funicle reddish black; trochanters dark red; femora dark red with darker, usually black, knees; tibiae dark red, becoming blackish near apex; scales generally tessellate, green and/or brown, paler on elytral declivity (elytra sometimes with pale mottling). *Head* and *rostrum* as in *A. nivosus*, except median rostral carina finer (indistinct in ♀) and scales contrasting less strongly in colour with those of body. *Antennae* as in *A. nivosus*. Prothorax about as long as broad in ♂, slightly broader than long in ♀, widest in middle, sides moderately and fairly evenly rounded; disc of pronotum flattened or weakly depressed, often with

traces of a narrow median carina, anterior third only weakly convex in profile view; otherwise as in *A. nivosus*. *Elytra* ovate, × 1·2 as long as broad in ♂, × 1·15 as long in ♀, sides moderately and evenly rounded in ♂, rather strongly rounded in ♀; disc flat in profile view, flat or weakly convex transversely; surface slightly uneven; strial punctures concealed by scales; strial granules prominent, mostly larger than surrounding scales and increasing in size towards sides but not as much, or as abruptly, as in *A. nivosus*; scales mostly tessellate or weakly imbricate; setae similar to those on scape. *Sternum* as in *A. nivosus*. *Sexual dimorphism* strong; antennal scape more slender in ♀; setae on scape, elytra and legs more nearly erect in ♀ and those on elytra larger; setae on femora of ♂ usually subrecumbent; fore and middle tibiae of ♂ distinctly incurved towards apex, those of ♀ almost straight; apical third of fore tibia of ♂ compressed, bluntly carinate dorsally (evenly rounded in ♀); elytral processes of ♂ similar to those of *A. nivosus* but longer, less strongly tapering and distinctly diverging, often weakly curving dorsolaterad, apex with fringe of long soft mostly pale setae; sides of elytra strongly narrowed at process bases, so that, although they diverge, their spread is distinctly less than greatest width of elytra proper (Fig.235); elytral processes of ♀ very short but acute, cone-shaped, diverging, their spread distinctly less than greatest width of elytra proper (Fig. 236); they are covered with dense dark stiff erect setae and surmounted by a short fringe of slightly longer, soft pale setae; EPI 139–145 (♂), 109 (♀).

Genitalia. Median lobe of aedeagus (Fig. 148) × 0·6 as long as pronotum and about × 3 as long as broad; struts × 2·5 as long as median lobe; flagellum × 6·8 as long and × 3·8 as long as pronotum (two observations). Spermatheca (Fig. 152) with tail about as large as body.

Holotype ♂, Papua New Guinea: Madang District, Finisterre Range [Upper Nankina], Teptep, 8500 ft [2550 m], vii.1975 (*R. W. Hornabrook*), in BMNH.

Paratypes. 4 ♂, 1 ♀, same data as holotype (3 RWH, 2 BMNH).

Specimens examined: 6; dissected: 3 (2 ♂, 1 ♀).

This species differs from the other two members of the group in its duller, brownish colour and its strong sexual dimorphism.

The name ('black-knees') is a noun in apposition.

Apirocalus (Apirocalus) bacchusi sp. n.

(Figs 8, 77, 149–151; Map 4)

Range. Madang District (Finisterre Range). Altitude: 2700 m.

Length, ♂: 9·0 mm; ♀: 10·5 mm. Black, legs dark red (coxae and tarsi black); scales pale green (many glittering), paler still on declivity (pearly on head and sternum). *Head* and *rostrum* as in *A. nivosus* except eyes smaller, frons without traces of a median carina and median rostral carina variable (sometimes absent). *Antennae* with funicle and club as in *A. nivosus*; scape strongly flattened, ± parallel-sided beyond basal third, apex simple; upper surface rugulose or not, covered with ovate subcontiguous scales; setae on leading edge distinctly shorter than those on funicle and more strongly curved, brown or hyaline, only about half as long as greatest diameter of scape. *Prothorax* slightly longer than broad in both sexes, widest in or behind middle; sides moderately and fairly evenly rounded; disc broadly flattened or weakly depressed, with traces of a narrow median carina; upper surface variably granulate – in ♀ granules few, small and confined to discal depression, in ♂ numerous, of various sizes and covering entire upper surface and upper part of sides; setae small and inconspicuous. *Elytra* ovate, × 1·25 as long as broad, disc weakly convex or almost flat, surface slightly uneven but without distinct transverse folds; strial punctures very small, completely obscured by scales; strial granules small (× 1–2 diameter of surrounding scales), not increasing in size towards sides; interstrial granules smaller still, their setae small and inconspicuous in ♂, larger in ♀ (those on interstriae 6 and 7 larger than those on scape), always dark brown; elytral processes of ♂ elongate, tapering, somewhat flattened and with distinct edge on outer side but still very thick to near apex, weakly rising or curving upwards and only moderately diverging so that spread about equals greatest width of elytra proper; processes of ♀ shorter, more strongly tapering and scarcely rising at all; EPI 148–150 (♂), 140 (♀); scales contiguous or imbricate throughout except for dark zone on mesodorsal aspect of processes where only small separate brown scales occur. *Sternum* as in *A. nivosus* but ventrite 1 with wider scale-free border behind hind coxae. *Legs* as in *A. nivosus* except setae throughout smaller and subrecumbent.

Genitalia. Median lobe of aedeagus (Figs 149, 150) half as long as pronotum and three times as long as broad; struts × 2·7 as long as median lobe; flagellum × 6·6 as long as median lobe and × 3·5 as long as pronotum (one observation). Spermatheca (Fig. 151) as in *A. nivosus*.

Holotype ♂, PAPUA NEW GUINEA: Finisterre Range, Upper Naho Valley, S. side of Mt Abilala, *c.* 9000 ft [2700 m], Station No. 102, 19–22.xi.1964 (*M. E. Bacchus*), in BMNH.

Paratypes. 1 ♂, 1 ♀, same data as holotype (BMNH).

Both paratypes are severely abraded and the female is damaged.

Bacchus, in this instance, is a modern personal name (a variant of *Backhouse*) and the name of this species has been formed accordingly.

The *hydrographicus*-group

Elytra distinctly to very strongly convex on disc, both transversely and in profile view, often globose; processes variable, dimorphic or not. Pronotum flat or weakly convex in profile view, with a ± distinct (though totally undefined) depression in basal third; greater part of surface with separate, well defined shiny granules which are sometimes divided along mid-line. Antennal scape capitate or not, setae on leading edge usually (but not always) small and recumbent; club ×0·3 as long as pronotum. Rims of pterygia microreticulate in both sexes and ♀ without large setae on postero-ventral margin of prothorax. Scales in ♂ reduced or absent on dorsum but usually forming pale stripe at sides, at least on elytra; ♀ similar or with more uniform scaling; antennal funicle without any scales, tarsi usually without (sometimes a few on segments 1 and 2 of hind tarsi). Mesepisternum usually with scales, arms of mesosternum usually without. Median lobe of aedeagus ×2·1–2·7 as long as broad and ×0·4–0·5 as long as pronotum, weakly curved in profile view, sides ± parallel, widening before the very broadly rounded apex (Figs 154, etc.); struts ×2·8–3·9 as long as median lobe and ×1·4–1·7 as long as pronotum; manubrium distinctly longer than median lobe; flagellum short or very short. Spermatheca variable; styli of ovipositor ×3·2 as long as broad (one observation).

A well defined group of species with an easterly range, mostly occurring at fairly low altitude. The reduced flagellum of *A. vexillarius* is seen again in *A. cornutus* (*cornutus*-group) and the spermathecae of these two species are similar.

Apirocalus (Apirocalus) hydrographicus Marshall

(Figs 9, 154–157, 161, 162; Map 5)

Apirocalus hydrographicus Marshall, 1956 : 18, fig. 4. Holotype ♂, PAPUA NEW GUINEA (BMNH) [examined].

Range. Northern District. Altitude: 300–1300 m.

Length 7·8–10·5 mm. Black, with femora, tibiae and antennal funicle usually reddish black but entirely red-brown (immature) specimens frequent; scales in ♀ usually dense, mainly pale brown or greenish white, in ♂ white or greenish white and sparser, sometimes confined to lateral and declivital patches on elytra and sides of prothorax and metasternum. *Head* with frons very weakly declivous (often almost in line with rostrum in profile view), weakly but fairly regularly rugose, rugae at sides extending obliquely across temples; eyes moderately convex (about as in *A. cornutus*); scales densest above eyes, smaller and sparser elsewhere, not, or only partly concealing frontal rugae. *Rostrum* with sides parallel from base, widening at genae; upper surface transversely convex, sides weakly and gradually narrowed behind antennal insertions; apex evenly rounded in profile view, oblique; median rostral carina broad, distinctly raised, smooth, glossy, extending from base to level of antennal insertions or even beyond, flanked by sulci containing one or more cariniform rugae; scales confined to posterior part of dorsal surface and extending over ill-defined margins on to sides but few, if any, scales on outer surface of pterygia; setae on posterior part of dorsal surface white, truncate and recumbent. *Antennae* with funicle segments 1 and 2 subequal and ×2·1–2·6 as long as broad, 3 ×0·6–0·7 as long as 2, 4–7 subequal, slightly shorter than 3 and ×1·1–1·4 as long as broad; club ovate, ×2·3–2·8 as long as broad; scape weakly and smoothly sinuous, weakly flattened, widening and thickening throughout from base, more strongly so near apex, forming a distinct head but without any abrupt constriction between it and shaft; upper surface fairly even, punctures simple or with raised lips which project through the often dense scales; setae on scape usually distinctly shorter than those on funicle, strongly curved, evenly distributed, recumbent or subrecumbent throughout. *Prothorax* as long as broad in ♀, slightly longer than broad in ♂, widest in, or a little in front of middle, thence moderately rounded apicad, evenly tapering basad, sometimes with a weak pre-apical constriction; greater part of dorsal surface strongly and evenly granulate, granules

separate, often divided along at least part of mid-line, diameter of largest equal to one-half to two-thirds that of funicle; scales dense on dorsal surface (between granules), sparser but larger on sides which are strongly rugose, larger still, paler and in part imbricate above coxae; setae throughout very small and inconspicuous. *Elytra* globose in ♂, subglobose in ♀, × 1·0–1·2 as long as broad; striae marked by deep punctures; strial granules about as large as punctures (but often indistinct); interstrial granules smaller and fewer than strial granules (often mostly absent) but their setae much larger (still only × 1–3 diameter of surrounding scales, so relatively small and inconspicuous); scales differing between sexes (see below). *Mesepisterna* with numerous, mostly large, scales and strong punctures of various sizes, containing linear appressed or recumbent setae which are whitish and conspicuous; arms of mesosternum without, or with fewer, smaller, scales, fewer setae and no strong punctures. *Metasternum* and ventrites 1 and 2 generally with dense scales and fine pale setae which arise from small granules; ventrites 3–5 with much smaller, sparser scales and smaller denser setae, of various sizes. *Legs* with femora moderately to rather strongly swollen, ± straight, hind femora distinctly compressed and often with a distinct edge dorsally (compared with middle femora); fore tibiae weakly incurved towards apex, middle tibiae weakly incurved throughout, hind tibiae ± straight; scales variable, smaller, on average, than those on elytra but concolorous with them, largest and densest on widest part of femur but not imbricate; setae linear, pale greenish or brownish, iridescent, mostly recumbent or weakly raised on femora, those on knees arising from small granules; setae on outer (dorsal) edge of tibiae small, strongly curved, mostly blunt, those on inner edge about twice as long, almost straight and finely pointed, often dark brown towards tibial apex; tarsi with hyaline or brownish setae, usually darker peripherally, thus forming a conspicuous fringe on segment 3 against pale background of projecting setae of ventral pads. *Sexual dimorphism* well marked; elytral processes small and well separated; those of ♂ arising from cone-shaped base, terete and subisodiametric in middle, curving upwards and inwards and becoming horizontally explanate towards apex, which bears a radiating fringe of long blackish or golden brown setae; processes of ♀ usually much shorter, strongly tapering, ± pointed and with reduced fringe but if elongate, weakly tapering, truncate and with long fringe, then straight and with planes of compression strongly tilted inwards; spread of processes in ♀ ± equal to greatest width of elytra proper, distinctly exceeding this in ♂; base of elytra distinctly raised (weakly keeled) in ♂, not, or indistinctly, raised in ♀; EPI 131–145 (♂), 114–131 (♀). Scales on elytra in ♀ usually dense and fairly uniform, paler and imbricate in shoulder region and across top of declivity (sometimes extending along processes); in ♂, area between suture and stria 6 with mostly small, separate scales, either pale or brown and inconspicuous, often with small clusters of larger pale scales; beyond stria 6 scales much larger and denser, either throughout or in patches but always present (and imbricate) in shoulder region (basal part of interstria 7); declivity with an isolated white blotch consisting of large imbricate scales (sometimes extending narrowly along processes). Disc of venter of ♂ very broadly and distinctly depressed, ventrite 5 broadly rounded at apex and distinctly foveate; disc of venter of ♀ not, or weakly, depressed, ventrite 5 ogival, indistinctly foveate but with apex deflexed ventrad.

Genitalia. Median lobe of aedeagus (Figs 154–157) × 0·4 as long as pronotum and × 2·1–2·3 as long as broad; struts × 3·3–3·8 as long as median lobe; flagellum × 2·0–2·3 as long as median lobe and × 0·8–1·0 as long as pronotum. Spermatheca (Figs 161, 162) with tail slightly smaller than body, tapering; gland-lobe distinct, its axis making a small (rarely large) angle with that of body; duct-lobe large, as broad as gland-lobe at base and curving 'dorsad' over the latter (five observations); gland large (about as long as body), slender; duct about twice overall length of spermatheca.

Holotype ♂, Papua New Guinea: 'Hydrog[r]. Mts. / 2500 ft. B.N.G.' (Janson MS) and 'Apirocalus hydrographicus Mshl. TYPE ♂' (Marshall MS), in BMNH.

Paratypes. 4 ♂, 3 ♀, same data as holotype (6 BMNH, 1 BPBM); 1 ♂, 1 ♀, 'Hydrographer Mts., / Brit. N.G., 2500 ft., / Feb. Mrch. 1918. / (Eichhorn Bros.),' (printed; apparently these data apply to all the Hydrographer specimens). One of the seven males listed by Marshall remains unaccounted for. 1 ♂, 1 ♀, Orrori [Kokoda, near The Gap], 3000 ft [900 m], vii.1933 (*L. E. Cheesman*); 1 ♂, Ishurava [Isurava], 3000 ft [900 m], vii.1933 (*L. E. Cheesman*) (all BMNH). All the above paratypes bear a Marshall MS label similar to that attached to the holotype but reading 'COTYPE ♂' (or ♀).

Other specimens. 27 ♂, 12 ♀, Mt Lamington, 1300–1500 ft [390–450 m] [pre-1930] (*C. T. McNamara*) (33 SAM, 4 BMNH, 2 AMNH); 1 ♀, Mt Lamington, 500 m, vi.1966 (*P. Shanahan*) (BPBM); 1 ♂, 1 ♀, Popondetta area, 8–10.iv.1966 (*R. Radzyner*) (DAPM); 1 ♂, Popondetta, 2–4.v.1970 (*J. Stibick*) (CWO'B); 4 ♂, 6 ♀, Managalase Plateau, xi.1972 (*R. W. Hornabrook*) (8 RWH, 2 BMNH); 1 ♂, Kokoda, 2000 ft [600 m], 3.xi.1957 (*J. Sedlacek*) (CWO'B); 1 ♀, Kokoda, 400 m, 14–16.xi.1965 (*J. Sedlacek*); 4 ♂, 2 ♀, Kokoda-Pitoki, 400 m, 23 and 24.iii.1956 (*J. L.*

Gressitt) (all BPBM); 1 ♀, Kokoda, v.1956; 1 ♀, Kokoda, Isuava-Biage valley, 4200–4400 ft [1260–1320 m], 5.vi.1956; 1 ♂, Biage valley, 1200 ft [360 m], 26.vi.1957 (all *J. Healy*); 1 ♂, 1 ♀, Igora Pltn, 23.iii.1956; 2 ♀, Mamoo Pltn [300 m], 22.iii.1956 (all *Szent-Ivany*) (all DAPM); 1 ♀, Asela, 1.xi.1966 (*G. Baker*) (CWO'B); 1 ♂, Saiko [?=Saiho], 13–17.i.1958 (*J. Smart*) (BMNH).

Specimens examined: 82; dissected: 12 (7 ♂, 5 ♀).

Bionomic data. 'In rainforest' (Biage valley, JH); 'On *Coffea canephora*' (Igora Pltn, S-I); 'On young cacao trees' (Mamoo Pltn, S-I).

The Mt Lamington specimens, of both sexes, are more densely scaled than those from the other localities, some females from which are as bare-looking as the males, notably the paratype from Orrori (which is also the largest specimen).

Apirocalus (Apirocalus) orientalis sp. n.

(Fig. 158; Map 5)

Range. Eastern extremity of mainland, beyond 149° E. Altitude: 1020–1320 m.

Length 8·2–9·2 mm. Differs from *A. hydrographicus* as follows. Elytral declivity entirely pale in both sexes, pale area sharply defined dorsally but not forming a discrete blotch between process bases; setae on leading edge of scape almost as long as, and stouter than, those on funicle, usually stiff and semi-erect; scales on prothorax more nearly uniform in size; elytral interstrial granules larger, about as large as strial granules, uniseriate on disc but irregular (and more numerous) towards base; hind femora not distinctly compressed, fore and middle tibiae less strongly curved (almost straight in ♀), setae usually distinctly raised on femora and outer edge of tibiae and all pale on tarsi. *Sexual dimorphism* less well marked than in *A. hydrographicus*; elytral processes of ♂ usually straight, weakly tapering throughout (not widening apically), fringe setae mostly brown (some pearly white anteriorly); EPI 125–133 (♂), 113–115 (♀); elytra densely squamose in both sexes but scales larger (and hence more conspicuous) in ♀.

Genitalia as in *A. hydrographicus* except flagellum slightly longer, × 2·4–2·6 as long as median lobe and × 0·9–1·1 as long as pronotum.

Holotype ♂, Papua New Guinea: Milne Bay District, Mt Mura [Mt Baritun] (30 [k]m NW. of Mt Simpson), Boneno, 4000 ft [1200 m], ix.1940 (*F. Shaw Mayer*), in BMNH.

Paratypes. Papua New Guinea: 1 ♂, 1 ♀, same data as holotype (BMNH); 1 ♂, Milne Bay District, Agaun [shown as in Central District on Map 9202], 4400 ft [1320 m], viii.1969 (*R. Pullen*) (ANIC); 1 ♀, Central District, Amazon Bay, Komania, 3400 ft [1020 m], 11–26.xi.1962 (*W. W. Brandt*) (ANIC); 1 ♂, 1 ♀, Milne Bay, vii, (*Wind*) (MCZ).

Specimens examined: 7; dissected: 2 (1 ♂, 1 ♀). The genitalia of the holotype were removed without dissection.

The elytral processes of the male resemble those of some females of *A. hydrographicus*; normal females of these two species can only be separated by their different scapal setae.

Apirocalus (Apirocalus) ater sp. n.

(Figs 10, 163; Map 5)

Range. Goodenough I. Altitude: 1600 m.

♀. Length 11·8–12·0 mm. Black, femora and tibiae blackish red; scales dense, pale greenish or bluish grey but very small, imparting matt appearance to dorsum but no obvious colour, larger and denser around elytral apex but not forming a distinct pale zone or blotch. *Head* and *rostrum* as in *A. hydrographicus* but eyes relatively smaller, scales smaller and almost confined to frons. *Antennae* as in *A. hydrographicus* but funicle segments slightly more elongate (segment 4 < × 1·8 as long as broad); scape (Fig. 10) almost straight, ± parallel-sided in basal three-quarters, thickening progressively throughout (more strongly near apex), flattened, surface strongly sculptured, apex very weakly swollen anteriad; setae scarcely more than half as long as longest setae on funicle, fine, stiff, ± raised, pale brown or hyaline; scales ovate and lanceolate, mostly lying in grooves between rugae. *Prothorax* as long as broad, widest in front of middle, tapering thence to extremities; dorsal surface with basal depression weak or obsolete,

evenly covered with well defined bead-like granules (denser than in *A. hydrographicus*), divided in posterior half by smooth median line; scales abruptly ceasing at sides; setae very small and inconspicuous; sides of prothorax strongly rugose and almost scale-free. *Elytra* subglobose, × 1·2 as long as broad; strial punctures very small and indistinct; strial granules well defined or not; interstrial granules as large as, or larger than, strial granules, irregularly uniseriate on disc, more irregular towards base, often fusing with each other or with strial granules; scales condensed at extreme base of interstria 6 (forming a very small pale fleck) and around apex, sides almost bare; setae generally minute, becoming larger towards apex where largest resemble those on tibiae and are distinctly larger than those on scape; elytral processes short, strongly tapering, compressed, strongly diverging but their spread only slightly exceeding greatest width of elytra proper; fringe setae mostly pale, grading to brown posteriorly; EPI 127–129. *Mesepisterna* with well defined punctures containing minute pale setae; arms of mesosternum with a few much smaller punctures containing similar setae; no scales on either of these parts or on mesosternal process. *Metasternum* and ventrites 1 and 2 with scales towards sides only; ventrites 3–5 without scales; setae throughout small, whitish or greenish, stiff and semi-erect, similar to those on tibiae; ventrite 5 weakly foveate, apex broadly rounded and deflexed ventrad. *Legs* as in *A. orientalis* but setae and scales much smaller; much of femora without, or with very small, well separated scales.

Genitalia. Spermatheca (Fig. 163) similar to that of *A. hydrographicus*; duct much longer, more than eight times overall length of spermatheca (one observation).

Holotype ♀, Papua New Guinea: Milne Bay District, Goodenough I., E. slope, No. 9, 1600 m, 7–23.x.1953 (*G. M. Tate*), Fourth Archbold Exp., in AMNH.

Paratype ♀. Same data as holotype (BMNH).

The largest known species and possibly the most easterly (competes for this with *A. orientalis*). Clearly related to *A. hydrographicus* but with much smaller scales and setae throughout; indeed it lacks scales on the sides of the elytra where, in *A. hydrographicus*, they are largest and densest.

Apirocalus (Apirocalus) vexillarius Marshall

(Figs 11, 159, 160, 164, 165; Map 5)

Apirocalus vexillarius Marshall, 1956 : 19. Holotype ♀, Papua New Guinea (BMNH) [examined].

Range. Central District. Altitude: *c.* 2000 m.

Length 8·2–9·0 mm. Dark or blackish red, apex of rostrum, sides and processes of elytra black, tarsi usually only slightly darker than tibiae; scales mostly dark brown and inconspicuous but forming a prominent pale creamy white stripe along sides of prothorax and elytra. *Head*, *rostrum* and *antennae* as in *A. hydrographicus* except scape (Fig. 11) more slender, smoother, widening slightly towards apex but not capitate, setae very fine and small, distinctly shorter than those on funicle, mostly brown, strongly curved and recumbent; scales very small and dense but concolorous with cuticle, so inconspicuous. *Prothorax* as in *A. hydrographicus* except sides less strongly rugose and sides of dorsal surface with tract of large, pale, partly tessellate or weakly imbricate scales extending from hind margin but evanescing before reaching anterior margin. *Elytra* ovate, × 1·2–1·3 as long as broad; disc ± strongly and irregularly granulate, sometimes also rugose; setae generally minute, larger on declivity but often inconspicuous even there; scales mostly dark brown, as on prothorax but with a pale longitudinal tract similar to that on prothorax and continuous with it, extending along interstria 7 from base to process which it narrowly ascends along its outer (dorso-lateral) edge; similar scales form an ill-defined fascia across upper part of declivity just below middle of process bases and extend along inner (ventral) edge of processes. *Mesepisterna* with numerous small, ill-defined punctures containing small setae and numerous small, often mostly brown, scales; arms of mesosternum smooth (apart from microsculpture) and bare. *Metasternum* and venter as in *A. hydrographicus* except ventrites 3–5 scale-free. *Legs* with femora moderately swollen, hind pair not distinctly compressed; tibiae almost straight; femora and tibiae with dense dark brown or greenish scales which are much smaller than those on elytra; setae on femora mostly pale, linear, ± curved and mostly recumbent, stouter but scarcely longer than those on scape; setae on outer edge of tibiae similar but semi-erect. *Sexual dimorphism* slight; elytra in ♂ more elongate and less strongly convex in profile view than in ♀ (cf. *A. hydrographicus*); elytra of ♀ strongly and evenly tapering to narrowly rounded apex which is strongly deflexed ventrad, apex in ♂ ogival and only slightly deflexed; processes in both sexes elongate, compressed and having edges on both sides distally, plane of compression strongly tilted inwards (especially in ♂), fringe setae pitchy, grading to whitish anteriorly; processes of ♂ more elongate but otherwise similar to those of ♀, their spread not, or only slightly exceed-

ing greatest width of elytra proper; EPI 148 (♂), 128–138 (♀); ventrite 5 ± distinctly foveate in both sexes but apex in ♀ deflexed ventrad (in sympathy with elytral apex).

Genitalia. Median lobe of aedeagus (Figs 159, 160) similar to that of *A. hydrographicus* but less strongly widening towards apex, half as long as pronotum and ×2·6–2·7 as long as broad; struts ×2·8 as long as median lobe; flagellum very short, ×0·3 as long as median lobe and < ×0·2 as long as pronotum. Spermatheca (Figs 164, 165) plump, tail smaller than body; gland-lobe very short, its axis making a strong angle with that of body; duct-lobe small, duct about equal to overall length of spermatheca.

Holotype ♀, PAPUA NEW GUINEA: 'OWGARRA / B. N. GUINEA / A. S. Meek' (printed), 'Apirocalus vexillarius Mshl. TYPE ♂' (Marshall MS), D. Sharp coll., in BMNH. Owgarra '. . . is somewhere behind Bereina but is not on maps. It is probably now non-existent' (J. N. L. Stibick, pers. comm.).

Paratype. 1 ♂, 'Brit New G' (MS), 'Nevinson Coll. / 1918–14' (printed), 'Apirocalus vexillarius Mshl. COTYPE ♂' (Marshall MS), in BMNH. Marshall attributes both specimens to Meek (*erratim* Meck) but I can see no justification for this.

Other specimens. 1 ♂, 1 ♀, Central District, Woitape, [*c.* 2000 m], 14–16.x.1963; 1 ♀, Goilala, Yemi village, 14.x.1963 (all *L. Smee*) (all DAPM).

Specimens examined: 5; dissected: 3 (2 ♂, 1 ♀).

Bionomic data. 'In native garden' (Woitape, LS).

Though clearly related to *A. hydrographicus*, this species differs from it in the similar appearance of the sexes and the fact that the female, not the male, is the more rotund sex.

Apirocalus (Apirocalus) inornatus sp. n.

(Map 5)

Range. Central District. Altitude: 700 m (?).

♀. Length 8·0–8·8 mm. Differs from *A. vexillarius* as follows. Scales throughout uniformly pale brown or pale green, without any trace of paler stripes composed of larger scales; elytral declivity slightly paler than disc but without a transverse fascia between processes; eyes distinctly more strongly convex; EPI 123–132.

Genitalia. Spermatheca similar to that of *A. vexillarius* (differences probably not significant); duct of similar length.

Holotype ♀, PAPUA NEW GUINEA: Central District, Morokai [?=Moroka], R. Oberthür coll., in MNHN.

Paratype. 1 ♀, same data as holotype (BMNH).

The *cornutus*-group

Elytral processes variable, usually differing markedly between the sexes. Surfaces of pronotal and elytral discs even, granulate or not. Antennal club ×0·2–0·3 as long as pronotum; scape straight in distal three-quarters, flattened, parallel-sided or weakly and evenly widening distally, without any apical expansion or pre-apical constriction; setae on leading edge ± blunt, usually recumbent and distinctly shorter than greatest diameter of scape in middle of length (only slightly shorter in *A. c. tenuiscapus*). Rims of pterygia with transverse microsculpture (milled) in ♂, smooth in ♀ (but milled in both sexes of *A. paradoxus*); ♀ usually with fringe or cluster of very large stiff erect pale setae on postero-ventral margin of prothorax. Some tarsal and antennal funicle segments sometimes with dense scales. Median lobe of aedeagus simple, ×2·2–4·2 as long as broad, usually about half as long as pronotum (< ×0·86 as long in *A. paradoxus*); struts usually ×2·2–2·7 as long as median lobe (> ×1·47 in *A. paradoxus*) and ×1·1–1·6 as long as pronotum; flagellum variable – short and slender in *A. mus* (shorter than pronotum), in remaining species either very long (×2·3–4·3 as long as pronotum) or very short (×0·2 as long as pronotum) and, for its length, stout; internal sac lined with denticles of various types, some of which may be pigmented. Spermatheca with tail usually smaller than body, strongly reflexed; gland-lobe variable, always very large in species with short or very short duct (Fig. 82), usually smaller or obsolete in species with very long duct; gland claviform or pedunculate; duct-lobe about half as long as body, slender, tapering, straight or weakly sinuous; styli of ovipositor ×2·5–4·0 as long as broad.

This group may be recognized by the flattened but otherwise simple antennal scape with whitish or brown setae; these may be recumbent or semi-erect but are always ± blunt-tipped (*A. bacchusi* has a similar scape but with fine erect black setae on the leading edge). Females commonly have the elytral processes represented by obtuse angulations. This may be the ancestral condition in the group, since elongate processes, where they occur in females, exhibit great variety of form, as would be expected if they were secondarily and independently derived from angulations.

The species with a very long flagellum and spermathecal duct occur in the northern part of New Guinea, while those with a very short flagellum and spermathecal duct occur in the south. Both groups occur in the Central Highlands, where their ranges may overlap slightly.

The *cornutus*-group includes the only species of *Apirocalus* that occur down to sea level; two of these are widespread and of some economic importance. One of them, *A. ebrius*, originally described as a variety of *A. cornutus*, occurs throughout the northern part of New Guinea, from Oro Bay (near Popondetta) in the east to Maffin Bay and Noemfor I. in the west, in both the lowlands and in the hills. The various populations vary with altitude in a similar manner throughout the range, so that not only do all the lowland populations resemble each other but most upland populations (from a given altitude-range) are also similar, in spite of the fact that they are, in many cases, obviously isolated from each other. Possibly, a very careful study would enable these various upland populations to be distinguished but the value of such an exercise is questionable. The complexity of the problem is indicated in Fig. 22 (p. 244).

Apirocalus (Apirocalus) cornutus Pascoe

(Figs 12, 13, 16, 56–58, 61–63, 75, 82, 166–173, 176–181, 243, 244; Map 7)

Apirocalus cornutus Pascoe, 1881 : 590.

Range. Central Highlands, Gulf and Central Districts, Northern Queensland. Altitude: 1–1700 m.

Length 7·0–10·2 mm. Black or reddish black; parts of tarsi and sometimes femora, distinctly red or red-brown. *Head* with frons weakly declivous in mid-line, leaving a ± raised, horizontal, triangular area above each eye; surface impunctate and weakly rugose; eyes moderately and evenly convex (Fig. 16). *Rostrum* weakly widening apicad; upper surface flat, merging with epistomal area which makes an angle of about 30° with horizontal plane of rostrum; sides of upper surface weakly excised; median carina distinct, polished, extending from base to level of antennal insertions. *Antennae* with funicle segment 2 distinctly longer than 1 and about × 3 as long as broad, segment 3 × 0·6–0·8 as long as 2 and about twice as long as broad, segments 4–7 subequal, about × 0·7 as long as 3 and × 1·3–1·7 as long as broad; club ovate-acuminate, × 2·2–2·7 as long as broad. *Prothorax* at least as long as broad in ♂, sometimes slightly broader than long in ♀, widest in, or a little in front of, middle; sides moderately and fairly evenly rounded in ♂, often straighter and weakly tapering posteriad in ♀; almost entire surface punctate, punctures small and ill-defined on disc, becoming much larger at sides, with narrow interstices which form a hexagonal mesh pattern; disc, near mid-line, with an irregular cluster of 8–20 shiny bead-like granules, varying greatly in size in each specimen but, on average, larger and more prominent in ♀. *Elytra* short oblong-ovate, × 1·1 as long as broad in ♂, × 1·2 as long in ♀; sides moderately and evenly rounded; disc moderately and evenly convex, at least transversely; declivity very steep, not, or only weakly, raised along suture; strial granules ± distinct, interstriae without granules. *Mesepisterna* with imbricate scales and pale setae; arms of mesosternum with contiguous or imbricate scales and no setae. *Legs* stout, femora strongly swollen, especially in ♂; fore and middle tibiae of ♂ strongly incurved very near apex, less so in ♀. *Sexual dimorphism* well marked; elytral processes of ♂ flattened, blade-like, ± strongly tapering to a broadly rounded apex; outer margins with sharp edges, diverging continuously from bases to near apices, so that spread of processes distinctly exceeds greatest width of elytra proper; inner (posterior) margins blunt, evenly rounded (in section); planes of processes distinctly tilted inwards; processes of ♀ variable but usually much shorter and stouter than those of ♂.

Genitalia. Flagellum very short, at most only slightly exceeding greatest width of median lobe of aedeagus. Spermatheca plump, tail smaller than body, curved, tapering; gland-lobe prominent, its axis making a large angle with axis of body; gland slender, claviform; duct-lobe short, tapering, ± straight; duct about half overall length of spermatheca.

The very short flagellum and spermathecal duct distinguish this species unequivocally from all others, except *A. paradoxus* and *A. vexillarius*.

Apirocalus (Apirocalus) cornutus cornutus Pascoe

(Figs 12, 16, 56–58, 75, 82, 166–169, 176, 177, 243, 244; Map 7)

Apirocalus cornutus Pascoe, 1881 : 590; Fairmaire, 1881 : 290; Waterhouse, 1883 : pl. 129, fig. 9; Pascoe, 1885 : 209; Faust, 1892 : 189; 1899 : 13; Ballard, 1927 : 297, 298, *partim*; Marshall, 1956 : 18; Szent-Ivany, 1956 : 83, *partim*; Voss, 1958 : 209; Szent-Ivany, 1959 : 427–428, *partim*; 1961a : 145; Simon Thomas, 1962 : 11, etc.; Szent-Ivany, 1962 : 5; Szent-Ivany & Ardley, 1963 : 130; Smee, 1964 : 23, 24, fig. 4; 1965 : 100; Le Pelley, 1968 : 111, 441, *partim*; Szent-Ivany, 1972 : 561b, 562, fig. k; Gray & Wylie, 1974 : 73, *partim*; Lamb, 1974 : 108, 113, 116, fig. 27. Holotype ♂, PAPUA NEW GUINEA (BMNH) [examined].

Apirocatus cornutus Pascoe; Faust, 1897 : 232 [*lapsus*].

[*Apirocalus gestroi* Pascoe; Voss, 1958 : 209. Misidentification.]

Range. Gulf and Central Districts, Darnley I., Murray I., Cape York. Altitude: 1–600 m.

Length 7·0–9·8 mm. Scales usually pale pearly grey throughout (when clean) and very dense or imbricate; setae mostly white, flattened, truncate and recumbent. *Head* between and below eyes with imbricate, compacted scales which become smaller, separate and metallic on vertex; rostro-frontal furrow deep and wide (except in mid-line) but true size concealed by overhanging scales; scales and setae on upper surface of rostrum similar to those on frons; genae and pterygia with looser scales and larger setae. *Antennae* with funicle segments 4–7 about ×1·3 as long as broad; club ×2·2–2·5 as long as broad, ×1·2–1·6 as wide as funicle and ×0·7–0·9 as long as segments 5–7 together; segments 2–4 usually extensively covered with round scales, segments 1, 5, 6 and (rarely) 7 with round or lanceolate scales, or both; setae on segments 2 and 3 pale, flattened, truncate and recumbent, grading apicad to dark, semi-erect, finely pointed bristles on segment 7; scape (Fig. 12) straight or very weakly sinuous, parallel-sided, thickening evenly in distal half, surface with fine punctures and some rugae but both almost entirely concealed by scales; setae on leading edge pale, strongly curved and recumbent, longest about half as long as greatest diameter of scape in middle of length; those on upper surface similar but brown. *Prothorax* slightly broader than long in ♀; scales imbricate at sides, thus concealing punctures; setae pale, truncate and recumbent at sides, becoming smaller, narrower and browner on disc. *Elytra* with disc evenly convex in profile view; strial punctures largely obscured by scales; strial granules on disc usually smaller than surrounding scales and each bearing a pale, lanceolate, recumbent seta; interstriae each with a single row of similar but larger, often brown, setae; scales contiguous or weakly imbricate on disc, more strongly imbricate on sides and declivity; postero-dorsal aspect of processes with smaller, separate, brown scales which sometimes join up across suture to form a narrow dark transverse band; antero-dorsal aspect of processes often with larger, brighter scales, especially in ♂; setae in process fringes pale anteriorly, grading rather abruptly to red-brown or pitchy posteriorly. *Metasternum* and ventrites 1 and 2 with large loose dense scales (imbricate towards sides) and subrecumbent linear setae (broader towards sides); ventrites 3 and 4 with smaller scales and setae, both usually interrupted in mid-line; ventrite 5 with scales similar and/or smaller still and a variety of setae: some flattened, semi-erect, as on preceding ventrites; some very small, linear, forming a sparse pubescence; some long, finely pointed, fringing ventrite apex. *Legs* with scales similar to those on body, largely imbricate and compacted; fore coxae with small scales among the setae on anterior and mesal aspects; setae on femora pale, truncate and recumbent; tarsal segments 1 and 2 with a loose incrustation of large imbricate scales; segments 3 and 5 of fore and middle tarsi with, at most, a few much smaller ovate or lanceolate scales among the dense recumbent setae; segments 3 and 5 of hind tarsi, however, usually with more and larger scales (though smaller than those on segments 1 and 2). *Sexual dimorphism* usually well marked but ♀ sometimes with raised crests which project strongly posteriad (Fig. 58); processes of ♂ with inner margins always curved, conjointly describing a wide, ± even curve in antero-dorsal view; EPI 122–140 (♂), 106–128 (♀); setae on postero-ventral margin of prothorax of ♀ variable, often only as long as segment 3 of antennal funicle and scarcely visible from above; ventrite 5 of ♂ with two prominent but ill-defined longitudinal carinae which diverge weakly posteriad; ♀ with weaker carinae and apex of ventrite deflexed ventrad.

Genitalia. Median lobe of aedeagus (Figs 166–168) about half as long as pronotum and ×2·2–2·5 as long as broad; struts ×2·5–2·7 as long as median lobe and ×1·3–1·5 as long as pronotum; flagellum distinctly shorter than greatest width of median lobe, ×0·2 as long as pronotum; intermediate section of internal sac with double row of pigmented denticles. Spermatheca (Figs 176, 177) with gland-lobe prominent, dome-shaped or slightly elongate.

Holotype ♂, [PAPUA NEW GUINEA: Central District,] 'Yule Island' (Pascoe MS, on oval blue-surfaced disc) [pre-1877 (*James*)]; 'Apirocalus cornutus Pasc. type' (Pascoe MS), in BMNH. Apparently unique (see below).

Distribution. (Localities listed, as far as possible, from west to east.) PAPUA NEW GUINEA: Gulf District, Kikori; G.D., Ihu, Orokolo; G.D., Maura and Vaiviri Pltn; G.D., Kerema; G.D., Murua River; G.D., Murua Agric. Sta.; G.D., Iriri; G.D., Cupola Est.; G.D., Epo Est.; Central District, Mekeo, Aipeama; C.D., Beipa'a; C.D., Bereina, Epo Agric. Exp. Sta.; C.D., St Joseph's [Angabunga] River; C.D., Yule I.; C.D., Doa Est.; C.D., Aroa Est.; C.D., Rorona; C.D., Lolorua Pltn; C.D., Redscar Bay; C.D., Redscar [Vari Vari] Is; C.D., Koitakinumu; C.D., Laloki; C.D., Catalina Est.; C.D., Brown River; C.D., Vanapa River; C.D., Goldie River; C.D., Hombron Bluff; C.D., Port Moresby; C.D., Bomana; C.D., 14-mile Farm; C.D., Owers Corner; C.D., Rouna; C.D., Rouna, Riverside Inn; C.D., Astrolabe Range, Variarata; C.D., Bisianumu; C.D., Bisianumu Exp. Sta.; C.D., Sogeri; C.D., Moroka; C.D., Red Shield Farm; C.D., Kanosia Est.; C.D., Moare Pltn; C.D., Ninda Est.; C.D., Eriama Est.; C.D., Imita Ridge; C.D., Subitana; C.D., Subitana Pltn; C.D., Musgrave River; C.D., Javerere Pltn; C.D., Koitaki; C.D., Koitaki Est.; C.D., Daradai; C.D., Daradai Pltn; C.D., Kapakapa; C.D., Rigo; C.D., Rigo, Dorom; C.D., Kapagere. AUSTRALIA: Queensland, Darnley I.; Q., Murray I.; Q., Cape York, Blue Mts.

Specimens examined: 759; dissected: 27 (14 ♂, 13 ♀).

Additional (published) records. Haveri, Dilo, Hughibagu, Paumomu River, 1890–93 (*L. Loria*) (Faust, 1899 : 13).

Doubtful records. Chief among these is a series of 11 specimens labelled as taken on cacao and sweet potato at Mamoo Pltn on 11.ix.1957 by Szent-Ivany. This locality is in Northern District, near Popondetta, on the opposite side of the Owen Stanley Range from the established range of the species. This record is, however, supported by two specimens labelled as taken at Sangara, also near Popondetta, on 19.iii.1956 by E. S. Brown and another allegedly taken at Kokoda, 3.xi.1957, by J. Sedlacek. Dr Szent-Ivany (pers. comm.) considers it likely that *A. cornutus* has been introduced into Northern District, possibly by aircraft operating between Port Moresby and Kokoda or Popondetta. Records for Daulo Pass (x.1957, J. Sedlacek) and Ternate are almost certainly false. A specimen labelled 'King's Sound, N. W. Aust.' would be an interesting record, if confirmed. This, and other specimens labelled 'N. W. Australia', appear to belong to the Gulf District form of the species (see below).

The earliest record known to me is a pair of specimens from a small collection of insects, presented to the British Museum by John MacGillivray in January, 1851 which had been collected on the voyage of H.M.S. *Rattlesnake*. One of the specimens bears a label, 'Redscar Isles, S. coast of N. Guinea'. There can be little doubt that this refers to the Pariwara Is, off Redscar Head, described in some detail by MacGillivray in his account of the voyage (1852 : 290) and which are shown on recent maps as the Vari Vari Is. McGillivray records having visited the largest of the islands with a survey party on September 21st, 1849.

Bionomic data. *A. c. cornutus* has been found in rainforest (both primary and secondary) and in pasture; it has been observed on some 40 plant species, at least 12 of which were being damaged, namely coffee, cacao, rubber, rice, cassava, avocado pear, asparagus, coconut, kenaf (*Hibiscus cannabinus* Linnaeus), *Amaranthus tricolor* Linnaeus, balsam and rose.

Local variation. All the specimens from Gulf District and a small adjoining part of Central District (Aipeama) show a marked reduction in size and extent of the scales on the antennal funicle; these are often confined to segments 2 and 3 and even there they are largely replaced by recumbent hairs. The scales on segments 3 and 5 of the hind tarsi are similarly reduced or absent and the scales on the femora are sometimes small, separate and metallic. A similar reduction in funicle and tarsal scales occurs in populations at the other end of the range, in the Musgrave river valley and some adjacent localities, though the southernmost specimens, from Kapakapa and Kapagere, have normal scales. In the area around the Brown River, including Redscar Bay, the elytral processes of some females take the form of raised longitudinal crests which project posteriad beyond the elytral apex, so that the specimen resembles the male of a different species. Similarly, the processes of some males from this area are broader and swept back at a narrower angle to each other than usual. A complete series of intermediates has been observed between these and normal specimens in the Brown River population. Females from Yule I., the type-locality, often have broadly rounded elytral processes, weakly projecting posteriad but not raised

to form crests. The processes of Yule I. males also tend to be intermediate in shape between those of the Brown River form and the other mainland populations. The Torres Strait and Cape York specimens agree with those from the Port Moresby area except that they are of smaller average size and all have distinctly more strongly convex eyes (probably not, however, exceeding the limit of convexity to be found in some mainland populations).

A. cornutus was the first species of *Apirocalus* to be collected (see above) and the first to be described. Many other species have hitherto been confused with it and this has made the identification of references difficult. When in doubt about a reference, e.g. if no distribution is given, I have included it here.

The source of Pascoe's Yule I. specimens is uncertain. It is highly likely that the holotype came from a collection made by Dr James, parts of which were obtained by both the British Museum and A. Fry from Mr Higgins in 1876. Pascoe's collection also contains a set of this material, so it is reasonable to assume that his specimens are from the same lot. It also seems evident that he described *A. cornutus* before seeing the D'Albertis material (although Fairmaire reported on a D'Albertis specimen later the same year). This view is supported by the fact that the description appears to be based on a single specimen. It certainly refers to the male sex only and only the holotype among Pascoe's specimens fits the single length dimension given (5 lines). This is assuming that the rostrum is included; if it is not, then the dimension lies outside the observed range for the species. The holotype, rostrum included, measures 10·4 mm; 5 lines on the English scale = 10·6 mm. Fairmaire (1881 : 290) gives the length as 12 mm which is near 5 lines on the French scale (11·25 mm) (von Hayek, 1973 : 11). Fairmaire also draws attention to the incorrect type-locality (Fiji). Pascoe was prone to this particular kind of error; in his revision of *Catasarcus* (1870) he gives incorrect type-localities on three separate occasions.

Apirocalus c. cornutus may be distinguished from the other subspecies by its smaller, often reddish, antennal club and by the fact that it usually, perhaps always, has scales on the fore coxae. Throughout the greater part of its range it may be recognized by the large dense scales on antennal funicle segments 2–4(–6).

Apirocalus (Apirocalus) cornutus tenuiscapus subsp. n.

(Figs 13, 170, 171, 178–180; Map 7)

Range. Central District (Goilala Subdistrict). Altitude: 600–2550 m.

Length 7·1–10·2 mm. Differs from the nominate subspecies as follows. Setae on head and body narrower, those on elytra often semi-erect; antennae with funicle segments 4–7 slightly more elongate, × 1·4–1·7 as long as broad, club slightly larger but, on average, more elongate, × 2·4–2·7 as long as broad, × 1·6–1·9 as wide as funicle and × 0·9 as long as segments 5–7 together; funicle segments never with dense scales, segments (1), 2 and 3 with rather dense recumbent silky hairs and usually a few very small ovate scales, other segments with finer hairs and no scales; setae on proximal funicle segments less strongly raised and only slightly stouter than those on distal segments; scape (Fig. 13) more slender, very gradually and evenly widening from near base, setae less strongly curved, in length usually distinctly exceeding half greatest diameter of scape in middle of length; prothorax slightly more elongate (as long as broad in ♀); disc of elytra of ♂ less convex in profile view; fore coxae seldom with any scales, segments 1 and 2 of fore and middle tarsi with fewer, smaller, scales and segments 3 and 5 of hind tarsi usually without scales; hind tarsal claw-segment usually longer, × 2·0–2·3 as long as segment 3; elytral processes of ♀ rounded, obtuse, not projecting posteriad and never forming raised crests; EPI 125–135 (♂), 107–117 (♀); setae on postero-ventral margin of prothorax usually much longer than funicle segment 3 and clearly visible from above.

Genitalia. Median lobe of aedeagus (Figs 170, 171) more slender than in *A. c. cornutus*, × 2·4–2·7 as long as broad; struts shorter, × 2·2–2·5 as long as median lobe and × 1·1–1·3 as long as pronotum; flagellum about equal in length to greatest width of median lobe. Spermatheca (Figs 178–180) variable.

Holotype ♂, Papua New Guinea: Central District, Mafulu, 4000 ft [1200 m], i.1934 (*L. E. Cheesman*), in BMNH.

Paratypes. Papua New Guinea: 17 ♂, 11 ♀, same data as holotype (26 BMNH, 2 BPBM); 1 ♂, 1 ♀, Mondo, 5000 ft [1500 m], i–ii.1934; 1 ♂, 1 ♀, Mt Tafa, 8500 ft [2550 m], ii.1934;

3 ♂, 1 ♀, Diene, 2000 ft [600 m], xi.1933 (all *L. E. Cheesman*) (all BMNH); 4 ♂, 4 ♀, Tapini, *c.* 3200 ft [960 m], 12 and 15.vi.1960; 1 ♂, Tapini, in Govt coffee block, 11.vi.1960; 5 ♂, 2 ♀, Metsialavava Pltn, 5000 ft [1500 m], 16.vi.1962; 1 ♂, 2 ♀, near Tatupiti, *c.* 4000 ft [1200 m], 11.vi.1960; 1 ♂, Iemi No. 1 village, *c.* 6000 ft [1800 m], 20.viii.1963 (all *Szent-Ivany*); 1 ♂, Perumeva, 12 miles [19 km] N. of Tapini, *c.* 4500 ft [1350 m], 14.vi.1962; 1 ♀, Lipuava, *c.* 5000 ft [1500 m], 14.vi.1962; 3 ♂, 3 ♀, Bapiti, Kovatapa hamlet, NE. of Tapini, *c.* 3000 ft [900 m], 13.vi.1963 (all *Szent-Ivany et al.*) (all DAPM); 23 ♂, 17 ♀, Tapini, 975, 1000 and 1100 m, 1957, 1961 and 1968 (*Brandt*, *Gressitts*, *Mena*) (38 BPBM, 2 BMNH); 7 ♂, St Joseph [Alabule] River, Madew, 2000–3000 ft [600–900 m] [pre-1909] (*W. Stalker*) (BMNH); 10 ♂, 6 ♀, Tororo [14 km NE. of Tapini], 1560 m, 15–24.ii.1958; 4 ♂, 4 ♀, Bome [10 km N. of Tapini], iii and iv.1958 (all *W. W. Brandt*) (all BPBM); 29 ♂, 18 ♀, Loloipa [11 km NW. of Tapini], 25.xi–31.xii.1957; 67 ♂, 43 ♀, Loloipa, 1.i–15.iii.1958 (all *W. W. Brandt*) (100 BPBM, 10 BMNH); 1 ♂, Mt St Mary, 1900 m, 15–21.vii.1968 (*Mena*) (BPBM); 2 ♂, 2 ♀, Kamulai, 2200 m, 14.v.1972 [*J. N. L. Stibick*] (DAPM).

Specimens examined: 298; dissected: 23 (12 ♂, 11 ♀).

Doubtful records. The above record for Iemi No. 1 village must be regarded as doubtful; this locality is believed to be near Woitape. Specimens labelled as from Itikinumu Estate (1), Subitana (2) and Wau (2) are unlikely to be genuine and a series of 8 specimens, allegedly from the Toricelli Mts, are certainly wrongly labelled.

Bionomic data. 'On Brussels sprouts', 'On cabbage' (Kovatapa, S-I *et al.*); 'Feeding on foliage of *Coffea arabica*' (Metsialavava Pltn, S-I); 'On *Crotalaria anagyroides*' (Govt coffee block, Tapini, S-I); 'In garden, causing shot-hole damage to foliage of *Passiflora edulis*' (Tapini, S-I); 'Village garden, on *Phaseolus vulgaris* in dense population' (Perumeva, S-I *et al.*); 'Secondary forest, on *Piper* sp.' (Tatupiti, S-I); 'Secondary forest, on *Pipturus argenteus*, s. l.' (Tatupiti, S-I); 'Village garden, on pumpkin' (Lipuava, S-I *et al.*); 'Feeding on *Solanum tuberosum*' (Iemi No. 1, S-I); 'On sweet potato' (Metsialavava Pltn, S-I).

Local variation. Two forms of this subspecies can be distinguished. One occurs in the lower part of the Alabule river system, on the eastern side (Miss Cheesman's specimens); the observed size-range is 7·1–8·6 mm and the flagellum is ×0·15–0·19 as long as the pronotum. The other form occupies the upper part of the same system (from Tapini to Mt St Mary); they are larger, 7·6–10·2 mm in length and the flagellum is slightly longer, ×0·21–0·25 as long as the pronotum.

This subspecies resembles *A. c. cornutus* in general appearance but may be distinguished by its more slender antennal scape and finer setae, especially on the sides of the prothorax and near the apex of the elytra. In addition, the elytra of the male are flatter dorsally and the width of the prothorax of the female is always smaller, in relation to the width of the elytra, than it is in the male (♀: 0·48–0·51, ♂: 0·55–0·62), whereas in *A. c. cornutus* the ranges for the two sexes overlap.

The range of *A. c. tenuiscapus* coincides almost exactly with that of *A. canus*; they have been taken together on several occasions. The type-locality of *A. c. tenuiscapus* is the same as that of *A. asper*.

Apirocalus (Apirocalus) cornutus virescens subsp. n.

(Figs 61–63, 172, 173, 181; Map 7)

Apirocalus cornutus Pascoe; Macleay, 1886 : 184 [?].

Range. Star Mts; Western District; Southern, Western and Eastern Highlands. Altitude: 400–1700 m.

Length 8·1–10·0 mm. Differs from the nominate subspecies as follows. Scales usually smaller, not, or less extensively imbricate, those on pronotum and elytra bright green or pale grey-green, those on head, antennal scape and legs coppery with green, blue and red reflexions; antennal funicle segments 4–7 more elongate, ×1·4–1·7 as long as broad; club slightly larger, ×1·7–1·9 as wide as funicle and ×0·86–1·00 as long as funicle segments 5–7 together; funicle segments with recumbent silky hairs, densest on segments 2 and 3, but rarely with any scales, setae on proximal segments almost as fine as those on distal segments; prothorax slightly more elongate (at least as long as broad in ♀) and distinctly smaller in ♀ than in ♂;

scales in middle of metasternum and venter smaller and well separated, setae finer and distinctly raised; fore coxae rarely with any scales, scales elsewhere on legs mostly smaller but a patch of large imbricate scales usually present on widest part of femora; segment 3 of tarsi usually without scales; elytral processes of ♂ usually longer and straighter, those of ♀ acute, their tips often produced beyond elytral outline, so that their spread about equals greatest width of elytra proper (Figs 61–63); EPI 132–148 (♂), 113–121 (♀); setae on postero-ventral aspect of prothorax of ♀ longer, on average, and clearly visible from above; ventrite 5 in both sexes weakly foveate and without longitudinal carinae.

Genitalia. Median lobe of aedeagus (Figs 172, 173) more slender, on average, than in *A. c. cornutus*, ×2·3–3·5 as long as broad, so that flagellum equals, or nearly equals, its width; struts, on average, shorter, ×1·1–1·4 as long as pronotum; intermediate section of internal sac with or without rows of pigmented denticles; gland-lobe of spermatheca (Fig. 181) broader and less well defined.

Holotype ♂, Irian Jaya: Star Mts, Sibil Valley, 1245 m, 18.x–8.xi.1961 (*S. Quate*), in BPBM.

Paratypes. Irian Jaya: 10 ♂, 5 ♀, same data as holotype (some *S. & L. Quate*) (11 BPBM, 4 BMNH); 4 ♂, 2 ♀, Star Mts, Bivac 36, 1220 m, 31.vii.1959 (*Leiden Mus. Neth. N. Guinea Exp.*) (RNH). Papua New Guinea: 5 ♂, 7 ♀, Western District, Olsobip, 400–600 m, viii.1969 (*J. & M. Sedlacek*) (10 BPBM, 2 BMNH); 1 ♂, 1 ♀, ditto, except 400 m and 26.viii.1969 (BPBM); 1 ♂, 3 ♀, Kuro River, 2.iii.1920 (*J. T. Zimmer*) (FMNH); 2 ♂, 2 ♀, Nomad, 25.x.1974 (*R. W. Hornabrook*) (2 RWH, 2 BMNH); 1 ♂, 1 ♀, Southern Highlands, Tari, Tigibi, 1600 m, 28.v–12.vi.1966 (*W. Vink*) (RNH); 1 ♂, Komo, 4800 ft [1440 m], 28.vii.1971 (*T. L. Fenner & R. Robartson*) (DAPM); 2 ♂, Nipa, Hegiso–Pimaga road, 25.xi.1969 (*B. Gray & H. Ivagai*) (DFB); 1 ♂, Lake Kutubu, 2400 ft [720 m], 17.ii.1971 (*R. W. Hornabrook*) (RWH); 1 ♂, Western Highlands, Hagen, Koibuga, 1500 m, 3.vii.1963 (*H. C*[*lissold*]); 2 ♂, 1 ♀, Eastern Highlands, Purosa, 1700 m, 17–25.v.1966 (*Gressitt & Tawi*); 1 ♀, Purosa, 1700–2000 m, 18.i.1966 (*J. Sedlacek*) (all BPBM); 2 ♂, Misapi, i.1968 (*R. W. Hornabrook*) (RWH, BMNH); 1 ♂, without locality (SAM).

Specimens examined: 58; dissected: 18 (15 ♂, 3 ♀).

Doubtful record. A series of five specimens in FMNH are labelled as taken at the Mongop Catholic Mission, New Ireland, by R. Starszak in 1967. Such a record would be inconsistent with the established distribution-pattern of the *cornutus*-group and I am bound to conclude that these specimens have been wrongly labelled.

Bionomic data. 'Native gardens' (Tigibi); 'On leaf of *Trema orientalis*' (Hegiso–Pimaga).

Local variation. The length of the elytral processes of the male varies with altitude as in *A. ebrius*; specimens from below 1000 m usually have EPIs below 140 whereas those from above 1000 m usually have EPIs above 140. When the processes are small, their inner margins conjointly describe a ± even curve but when they are large, the inner margins are straight and form a V in antero-dorsal view. Superimposed upon this variation is variation in the length of the median lobe of the aedeagus. In the west, as far east as Lake Kutubu, the median lobe is about half as long as the pronotum; from Lake Kutubu eastwards, it is three-quarters as long as the pronotum (though it is shorter in the two Purosa specimens).

The Gulf District form of the nominate subspecies is, in many respects, intermediate between typical *c. cornutus* and *c. virescens* but it has smaller elytral processes in the male and its body-scales are never green.

Apirocalus (Apirocalus) paradoxus sp. n.

(Figs 59, 60, 174, 175, 182; Map 7)

[*Apirocalus cornutus* Pascoe; Gray & Wylie, 1974 : 73, *partim.* Misidentification.]

Range. Chimbu; Southern and Eastern Highlands. Altitude: 1000–1680 m.

Length 7·8–10·5 mm. Female differs sharply from all other species in having elongate, tapering, incurving, caliper-like elytral processes (Fig. 60) with an extensive fringe of short, mostly pale setae along outer aspect (sometimes dark very near apex); elytral processes of ♂ (Fig. 59) normal, broad, resembling those of Brown River form of *A. cornutus* but more strongly diverging, their inner margins usually conjointly describing a smooth, even curve; EPI 130–140; setae of terminal fringe longer and all very pale brown (sometimes with a few shorter, dark setae at posterior end of fringe). Scales mostly small and separate, green or pale grey-green, those on femora usually very small, uniform and evenly distributed; widest part

of femora sometimes with larger, pink or coppery scales which may be locally subcontiguous but are rarely imbricate. Antennal funicle and segments 3 and 5 of tarsi without scales. Granules on pronotum more numerous and widespread than in *A. cornutus*, sometimes extending over entire dorsal surface. Elytral strial granules, on average, more prominent than in *A. c. virescens*; interstrial granules distinct. Rims of pterygia milled in both sexes; ♀ without any large erect setae on postero-ventral aspect of prothorax.

Genitalia. Median lobe of aedeagus (Figs 174, 175) ×0·8 as long as pronotum and ×3·7–4·2 as long as broad; struts ×1·4–1·6 as long as median lobe and ×1·2–1·4 as long as pronotum; flagellum shorter than greatest width of median lobe; internal sac with rows of pigmented denticles both in intermediate region and again posteriorly, where sac enters median lobe. Spermatheca (Fig. 182) as in *A. c. virescens*.

Holotype ♀, PAPUA NEW GUINEA: Chimbu, Karimui, 1000 m, 3.vi.1961 (*J. L. & M. Gressitt*), in BPBM.

Paratypes. PAPUA NEW GUINEA: 2 ♂, 4 ♀, same data as holotype (BPBM); 5 ♂, 9♀, ditto, except 2, 4, 5, 6, 7 and 8.vi.1961 (10 BPBM, 4 BMNH); 15 ♂, 8 ♀, Karimui, 2–3, 3 and 4.vi.1961 (*J. L. Gressitt*) (20 BPBM, 3 BMNH); 18 ♂, 6 ♀, Karimui, 1080 m, 8–10, 11–12, 13 and 14–15.vii.1963 (*J. Sedlacek*) (BPBM); 1 ♂, 1 ♀, Karimui, viii.1973 (*J. Sedlacek*) (CWO'B); 1 ♂, 4 ♀, Karimui, 1000 m, v.1969 (*H. Ohlmus*) (TM); 2 ♂, Karimui, 12.vi.1968 (*B. Gray*) (DFB); 8 ♂, 10 ♀, Karimui, *c.* 1972 (*R. W. Hornabrook*) (13 RWH, 3 BMNH, 2 MNHN); 1 ♀, Eastern Highlands, South Fore, Oriesa [*c.* 25 km SW. of Okapa], i.1964 (*R. W. Hornabrook*) (BMNH); 3 ♂, 4 ♀, Southern Highlands, Pangia, 5600 ft [1680 m], 17.vi.1975 (*R. W. Hornabrook*) (RWH).

Specimens examined: 103; dissected: 10 (6 ♂, 4 ♀).

Bionomic data. 'On *Hibiscus*', 'On leaf of shrub' (Karimui, BG). Gray's published record (Gray & Wylie, 1974 : 73) is 'On leaf of tree'.

The specimens from Pangia consistently have large coppery scales on their femora whereas in specimens from Karimui these scales are almost always small and green.

The development of the elytral processes of the female of this species is extraordinary and unique, though the Brown River form of *A. cornutus* may represent an early stage in a similar process of development. The fact that the pterygia of the female have milled rims (like the male) and that the long setae normally present on the postero-ventral aspect of the prothorax are absent, suggests that these apparent secondary sexual characters may be linked to the length of the elytral processes rather than to the sex of the specimen.

Apirocalus (Apirocalus) mus sp. n.

(Figs 21, 66, 67, 83, 183, 184, 206; Map 7)

[*Apirocalus cornutus* Pascoe; Ballard, 1927 : 298, *partim.* Misidentification.]

Range. Morobe District, Eastern Highlands. Altitude: 30–600(–1200 ?) m.

Length 5·7–7·0 mm. Black or reddish black, legs and antennae often more distinctly reddish; scales mostly pearly grey, very dense or imbricate except on antennal funicle and some tarsal segments; setae mostly pale and blunt. *Head* with frons distinctly declivous and finely rugose; eyes rather strongly convex but somewhat flattened on disc; rostro-frontal furrow wide and deep but true width concealed by overhanging scales; scales imbricate and compacted, becoming smaller, contiguous and metallic on vertex, those below eye imbricate but loose, those behind eye separate but very large, becoming smaller and sparser ventrally. *Rostrum* with sides weakly widening apicad, pterygia as wide as, or slightly wider than, genae; dorsal surface flat, sides distinctly emarginate behind antennal insertions; median carina variable, broad or narrow (sometimes obscured by scales), extending from base of rostrum to level of antennal insertions, or beyond; scales on dorsal surface (posterior to level of antennal insertions) imbricate and compacted, those on pterygia looser but still imbricate, extending thence to underside of base of rostrum. *Antennae* with funicle segments as in *A. cornutus*, except 1 and 2 equal and ×2·5 as long as broad; club (Fig. 21) ovate, stout, only twice as long as broad and 0·7–0·8 as long as 5–7 together but ×1·7–1·9 as wide as middle of funicle; funicle segments with dense silky hairs, broader, hence more conspicuous, on segments 1–3 and often accompanied on these segments by small, round, ovate or lanceolate scales; setae stiff, mostly brownish, blunt on proximal segments, grading to finely pointed on distal segments; scape as in *A. cornutus*. *Prothorax* as in *A. cornutus*, except length never exceeding breadth in ♂; discal

granules often arranged in two irregular rows in ♀, virtually absent in ♂. *Elytra* ovate, ×1·3 as long as broad in both sexes, sides evenly rounded, declivity steep, especially in ♂; suture weakly raised on declivity; disc evenly convex, more strongly so in ♀; strial punctures much larger than in *A. cornutus*, those on disc in ♂ often wider than the interstriae and regularly disposed, so that the interspaces form a rectangular mesh pattern (only visible in abraded specimens); strial granules minute or absent; interstriae each with a single row of mostly brown setae, similar in ♂ to those on sides of prothorax, in ♀ about twice as long and suberect; processes with dark, bronzy scales, declivity in ♂ with irregular but symmetrical dark marks (or dark with pale marks); setae in process fringes mostly dark brown but with some pale setae both anteriorly and posteriorly. *Sterna* and venter similar to those of *A. cornutus* but scales on ventrite 5 larger and more numerous. *Legs* as in *A. cornutus*, except hind femora subparallel near base (in profile view) and tarsal segments 3 and 5 without scales (segments 1 and 2 of fore and middle tarsi often scale-free also). *Sexual dimorphism* fairly well marked; ♂ with subhorizontal, blade-like processes (Fig. 66), similar to those of lowland *A. ebrius*, their spread only slightly exceeding greatest width of elytra proper; processes of ♀ (Fig. 67) forming a short crest, projecting posteriad, continuous or parallel with elytral outline when viewed from above; EPI 132–144 (♂), 127–133 (♀); prothorax relatively larger in ♂, its width ×0·62–0·66 that of elytra; prothorax of ♀ ×0·55–0·61 as wide as elytra; other differences as in *A. cornutus*.

Genitalia. Median lobe of aedeagus (Figs 183, 184) ×0·6–0·7 as long as pronotum, simple, evenly curved, ×2·3–2·4 as long as broad, apex weakly acuminate; struts ×2·5 as long as median lobe and ×1·5–1·6 as long as pronotum; flagellum ± straight, at least as long as median lobe and ×0·6–0·8 as long as pronotum; intermediate section of internal sac with double row of pigmented denticles. Spermatheca (Fig. 206) with tail very strongly flexed, strongly curved, weakly tapering; gland-lobe well defined, about as long as broad; gland pedunculate; duct-lobe elongate, tapering, ± straight; duct almost twice overall length of spermatheca.

Holotype ♀, Papua New Guinea: Morobe District, Singuawa River [15 km E. of Lae], 30 m, 11.iv.1966 (*P. Shanahan*), in BPBM.

Paratypes. Papua New Guinea: 4 ♂, 5 ♀, same data as holotype (6 BPBM, 3 BMNH); 2 ♂, 2 ♀, Bulem [Bulum] River, 64 km E. [*erratim* N.] of Lae, 30 m, 29.iv.1963 (*J. Sedlacek*) (BPBM); 1 ♂, Lae, Zenag, 20.iv.1965 (*Szent-Ivany*); 1 ♂, Nadzab, Pyramid Hill, 13.ix.1968 (*C. S. Li*); 1 ♂, Kaipit [Kaiapit], Sangar Pltn, 3.viii.1966 (*T. V. Bourke*) (all DAPM); 1 ♂, Kiapit, 950 ft [285 m], 19.ix.1925 (*E. Ballard*) (BMNH); 1 ♀, Markham River, 450 m, 18.vii.1963 (*J. Sedlacek*) (BPBM); 2 ♂, 2 ♀, Eastern Highlands, K[ai]n[an]tu, Kassam Pass, 2000 ft [600 m], 21.xi.1957 (*J. H. Barrett*) (2 DAPM, 2 BMNH); 1 ♂, 1 ♀, Morobe District, Bulolo, Sum Sum, 7–11.ii.1966 (*R. M. Stevens*) (DAPM); 1 ♂, 1 ♀, Bulolo, Sunshine Pltn, 20.iv.1965 (*J. Balogh & Szent-Ivany*) (TM); 1 ♂, Wau, 1200 m, 30.viii.1971 [*R. W. Hornabrook*] (RWH).

Specimens examined: 28; dissected: 11 (6 ♂, 5 ♀).

The above record for Wau requires confirmation.

Bionomic data. 'Nibbling on stem of *Imparata cylindrica*' (Zenag); 'From sugar-cane' (Pyramid Hill); 'On *Saccharum officinarum*' (Sangar Pltn); 'Ex cotton leaves' (Kaiapit, EB); 'In coffee blocks' (Sum Sum).

A. mus is the smallest member of the *cornutus*-group. Superficially, it closely resembles *A. ebrius* Faust but may be distinguished by its stouter antennal club and the lack of strial granules on the elytra. Its range lies entirely within that of *A. ebrius* and the two have been taken together on several occasions.

Apirocalus (Apirocalus) ebrius Faust **stat. n.**

(Figs 14, 17, 20, 22, 64, 65, 69, 70–74, 185–194, 197–204; Maps 5, 8)

Apirocalus cornutus Pascoe var. *ebrius* Faust, 1892 : 189.

Range. Northern New Guinea, Central Highlands, New Britain, Admiralty Is. Altitude: 0–2300 m.

Length 6·3–9·6 mm. Differs externally from *A. cornutus* only in its smaller average size, more strongly convex eyes and outline of elytra in ♂: sides, at process bases, shortly parallel or even converging posteriad (instead of widening throughout from base); ratio: width of prothorax/width of elytra, for the two sexes, does not overlap; ventrite 5 simple or weakly foveate in both sexes.

Genitalia. Flagellum very long, at least × 5 as long as median lobe; internal sac with unpigmented denticles. Spermatheca less plump than in *A. cornutus*; gland-lobe usually obsolete; duct very long (× 13 overall length of spermatheca in one measured example).

Hitherto confused with *A. cornutus* which has a more southerly range. Both species do, however, occur in the Central Highlands where their ranges are, as yet, imperfectly known.

Apirocalus (Apirocalus) ebrius ebrius Faust

(Figs 17, 20, 22, 64, 65, 73, 74, 185–190, 197–201; Map 8)

Apirocalus cornutus Pascoe var. *ebrius* Faust, 1892 : 189. LECTOTYPE ♂, Papua New Guinea (SMT), here designated [examined].

[*Apirocalus cornutus* Pascoe; Ballard, 1927 : 298, *partim*; Szent-Ivany & Barrett, 1956 : 41; Szent-Ivany, 1956 : 83, *partim*; 1958 : 435; 1959 : 427, *partim*; Szent-Ivany & Barrett, 1960 : 10; Simmonds, 1960 : 54; Szent-Ivany, 1960 : 536; 1961b : 10; Simon Thomas & Verloop, 1962 : 33; Szent-Ivany 1965 : 25; Szent-Ivany & Stevens, 1966 : 116; Anonymous, 1966 : 113, 114; 1969 : 59, 60, 67; Le Pelley, 1968 : 111, 441, *partim*; Bourke, 1969 : 1421; Gray & Wylie, 1974 : 73, *partim*. Misidentifications.]

Range. As for *A. ebrius*, s. l., less part of northern Morobe District and part of Central Highlands. Altitude: 0–2300 m.

Length, ♂: 6·3–8·4 mm; ♀: 6·3–9·4 mm. Scales dense or imbricate, usually pale pearly grey (when clean but often stained brown); antennal funicle and tarsal segments with or without scales; antennal club × 2·1–2·9 as long as pronotum; elytral processes variable in ♂ (Figs 64, 73) but always with a distinct outer edge, stout and angulate in ♀ (Fig. 65); EPI 118–150 (♂), 108–121 (♀).

Genitalia (Figs 185–190, 197–201).

Lectotype ♂, Papua New Guinea: with small square of gold-surfaced paper and 'N. Guinea / Richter'; 'ebrius / Faust' (Faust MS), in SMT.

Paralectotypes. 1 ♂, 2 ♀, labelled exactly as lectotype (SMT); 1 ♂, with 'Nov. Guinée'; 'Cotype'; 'Apirocalus ebrius Fst.' (Bovie MS); 'Collection Bovie / thru Buchanan' (printed) (NMNH). Faust records having 'zahlreiche Stücke' before him.

Distribution. Localities are listed, as far as possible, from west to east. Irian Jaya: Noemfor I.; Maffin Bay; Swart valley (Karubaka, 1300–1550 m; Kutsime; Guega); Archbold Lake, 760 m; Mulik River, 1050 m; Bokondini, 40 km N. of Baliem valley, *c.* 1300 m; Dafo; Genjam; Hollandia (Cyclops Mts; Lake Sentani; Tana Mera; Waris; Dojo; Kota Nica; Humboldt Bay; Pukusam Dist., W. of Tami River); Bewani Mts. Papua New Guinea: West Sepik District, Toricelli Mts (Siaute, sea level; Mobitei; Mokai; Sugoitei); W.S.D., Main [? May] River; East Sepik District, Dreikikir; E.S.D., Maprik (Bainyik; Kukwal; Suanimbu; Kaboibus); E.S.D., Wewak [Dallmannhafen] (Borum; Negoo Pltn); Western Highlands, Jimi River, 1400 m; W.H., Upper Jimi Valley (Wum, 840 m; Tsenga, 1200 m; Korop, 1300 m; Wana, 1500 m); Chimbu District, Chimbu Valley; C.D., Karimui; C.D., Nomane; Madang District, Bogia [Monumbo]; M.D., Aly; M.D., Tumleo; M.D., Dugumor Pltn; M.D., Adelbert Range (Wanuma, 800–1000 m; Utu); M.D., Alexishafen; M.D., Madang [Friedrich Wilhelmshafen] (Nagada Pltn; Dylup Pltn; Beon Nursery; Baitabag; Silibolo); M.D., Gogol River; M.D., Astrolabe Bay (Erema; Stephansort); M.D., Bundi, Bundikara, *c.* 30 km E. of Mt Wilhelm, 1650 m; M.D., Finisterre Range, Naho Valley (Damanti, 1065 m; Budemu, 1200 m; Moro, 1665 m); M.D., Saidor (Sibog, 500 m; Galumi, 600 m; Kiambavi, 1400 m); M.D., Karkar I.; M.D., Crown I.; M.D., Long I; Eastern Highlands, Goroka (Greathead's Pltn; Downes Pltn); E.H., Asoro; E.H., Okapa (Okasa; Agakamatasa); E.H., Kainantu (Tutor's Pltn; Yonki); E.H., Kassem Pass; E.H., Aiyura (Brechin Pltn; Kuminikura Pltn; Akivitana River); E.H., Gadsep, Arau; Morobe District, Umboi I. (Awelkom to Semo), 470–600 m; M.D., Kaiapit; M.D., Munum; M.D., Pyramid Hill; M.D., Wantoat; M.D., Boana Mission; M.D., Lambaeb, 900 m; M.D., Melambi River (Gawan, 600 m; Zitare, 1800 m; Samazing, 2100 m); M.D., Kalalo; M.D., Hudewa; M.D., Pindiu; M.D., Sattelberg; M.D., Finschhafen (Wareo; Timbulum Pltn); M.D., Bulem [Bulum] River; M.D., Rawlinson Range; M.D., Lae (and district); M.D., Kankumun;

M.D., Wanuru Pltn; M.D., Leuvomba; M.D., Bubia; M.D., Butibam; M.D., Gurakor; M.D., Nadzab [often written 'Nadyab']; M.D., Lake Wanum; M.D., Pesen; M.D., Markham River, 50 m, 450 m; M.D., Herzog Mts, Vagau, 1200 m; M.D., Snake River, 600 m; M.D., Muming [Mumeng], Mapos; M.D., Kuper Range; M.D., Mt Missim, 880–1400 m; M.D., Baimu River; M.D., Bulolo (and district), 700–1300 m; M.D., Wau (and district), 960–1700(–2500 ?) m; M.D., Edie Creek, 2000 m; M.D., Mt Kaindi, 2300 m; M.D., Asiki [Aseki]; M.D., Garaina; M.D., Pater Creek, 110 km S. of Lae; Northern District, Popondetta; N.D., Igora Pltn; N.D., Oro Bay (at N. end of Dyke Ackland Bay); Manus District, Manus I. (Lorengau; Momote); New Britain, Nakanai Mts (Talalo; Ti; Gisiluve), 900–1050 m; N.B., north coast, Sio, 600 m.

Specimens examined: 3470; dissected: 124 (80 ♂, 44 ♀).

Additional (published) records. Sepik District, Tamaui Pltn (Szent-Ivany, 1959 : 427); Madang District, Mirap; Morobe District, 17 km NE. of Biawa (Gray & Wylie, 1974 : 73, 74). Some records for the Central Highlands, given in the above papers under *A. cornutus*, may refer to the nominate subspecies, or to *A. e. angustus* or even to members of other species-groups. Records for Northern District may refer to *A. e. ebrius* or to *A. hydrographicus*; specimens of both have been seen from Igora Pltn and Popondetta.

Doubtful records. Those for Chimbu District (cited above) require confirmation. Some of Wagner's localities are very imprecise; for example, his Cromwell Range series includes both *A. e. wagneri* and *A. e. ebrius* (lowland form). Specimens in BPBM labelled 'New Britain, Gazelle Pen., 130 m' are of the upland form while some at least of the specimens labelled 'Neu Pommern' are known to be from New Guinea (see *A. e. wagneri*). Hence there are no undoubted lowland records for New Britain (or Umboi I.). DAPM specimens from Hohola, Port Moresby (♂) and M and V Estate, Ihu (♀) have almost certainly been wrongly labelled. Specimens from Daru I. and Oriomo River (Western District), both taken by H. Clissold early in 1964, support each other but, if genuine, can only be the result of an introduction. Other possibly introduced specimens include two from the Solomons (3.viii.1965, in FMNH) and two from the Philippines (Mindanao, Agusan, 13.xi.1959, in BPBM). Finally, there is a specimen in the Bovie collection (NMNH) labelled 'Nov. Hébrides'; 'Heller' and determined as *A. cornutus* by Heller.

The earliest dated specimen I have seen is a female from the Oberthür collection (MNHN) labelled 'Humboldt Bay. / Sept.–Oct. 1893 / W. Doherty' (printed) and 'var. / ebrius Fst.' (Faust MS) but the type-series is older (pre-1892).

Biological data. *A. e. ebrius* has been found on some fifty plants of various types, herbs, shrubs and trees. It has been observed eating the leaves of coffee, cacao, tea, taro, soya bean, cowpea, *Verbena* sp. and *Crotalaria* sp. There are also published records of it damaging leaves and flowers of banana (Szent-Ivany & Barrett, 1956 : 41), maize, pawpaw, mango, *Cassia* sp., *Cinchona* spp., *Grevillea robusta* A. Cunningham, *Euphorbia pulcherrima* Willdenow, *Cucurbita pepo* Linnaeus, *Paspalum conjugatum* Bergius, *Panicum palmaefolium* [*erratim palmarum*] Koenig (Szent-Ivany, 1958 : 435) and cotton (Ballard, 1927 : 297).

Local variation. Lowland populations, throughout the entire range, have small elytral processes in the ♂ and dense scales on funicle segments (1–)2–4(–6), tarsal segments 1 and 2 (3, 5) and fore coxae (at least on mesal aspect). Populations at higher levels have progressively larger processes (in the ♂), no scales on the fore coxae and show a progressive reduction in size and extent of the scales on the funicle and tarsi (see Fig. 22). Although scales disappear completely from the antennal funicle and fore and middle tarsi in some upland populations, they are retained on segments 1 and 2 of the hind tarsi. Elytral processes of the female are obtuse in lowland populations but right-angled or acute at higher altitudes (scales vary as in male). Some small, elongate males from Finschhafen superficially resemble *A. mus*; they may be distinguished from the latter by their much longer flagellum and the presence of distinct granules on the pronotum and along the elytral striae (these granules are obsolete in *A. mus*). The sample from Manus I. consists of 3 males and 2 females, measuring only 6·4–7·2 mm and having scales on segment five of each tarsus; similar specimens have, however, been observed among those from Finschhafen. The length of the flagellum varies from ×2·3 to 4·3 the length of the pronotum but is more restricted in any given population. Thus nine specimens from Oro Bay range from ×3·15 to 3·65. Specimens from Garaina, Wau, Mt Missim, Kassem Pass, Aiyura, Damanti (Finisterre

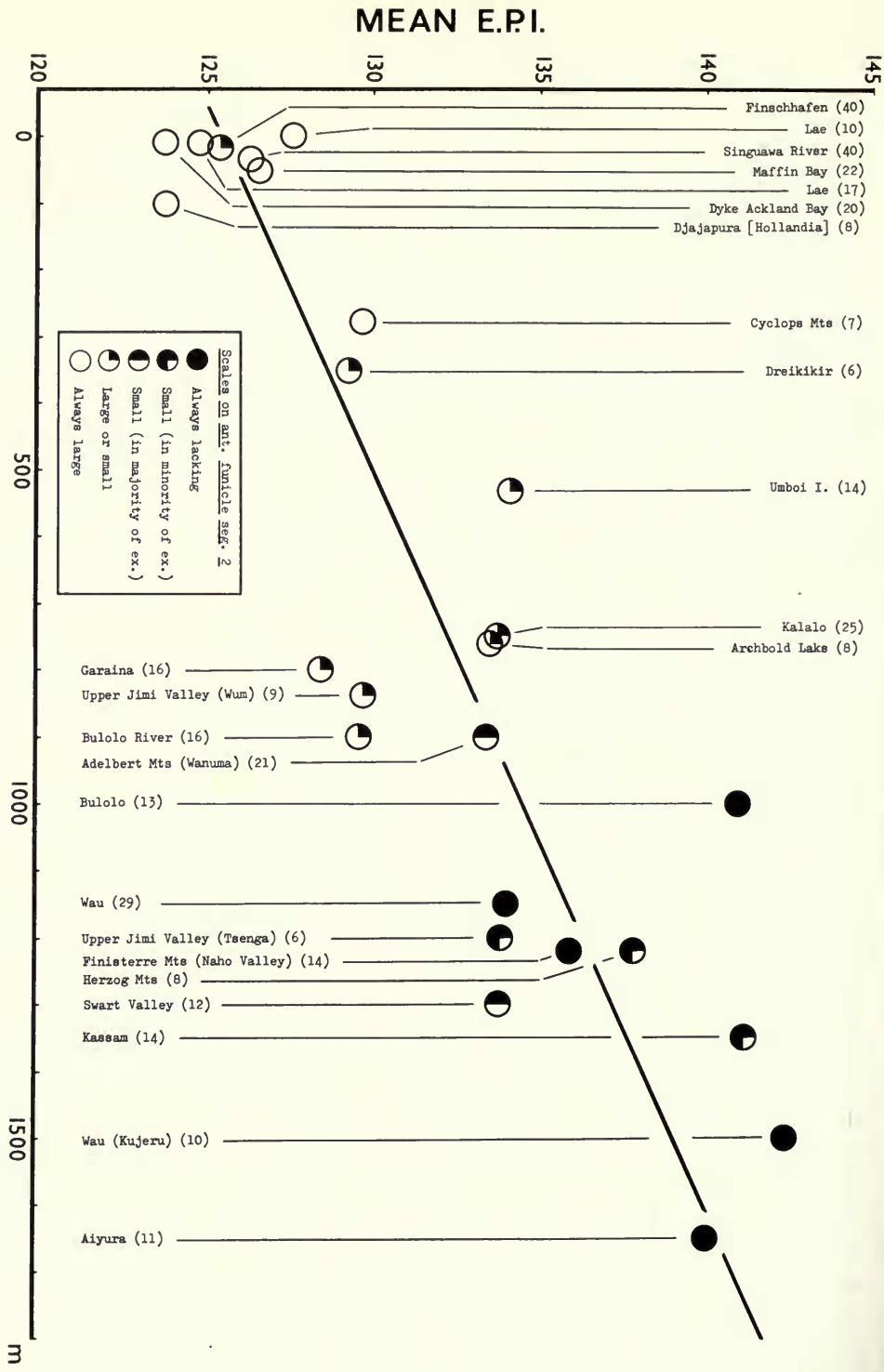


Fig. 22 *Apirocalus e. ebrius*. Graph showing relationship of length of elytral processes (as indicated by the EPI – see Fig. 3) and incidence of scales on antennal funicle and tarsi, to altitude. Number of specimens in each series is shown in brackets. ($y = 125{\cdot}4 + 0{\cdot}009x$; $r = 0{\cdot}897$) Discussion, p. 243.

Range) and Noemfor I. have similar ranges but five from Maffin Bay are ×2·3–2·5 as long as pronotum and two from Herzog Mts are ×4·1 and 4·3 as long. This variation is independent of the altitudinal variation and has no discernible pattern.

Owing to convergence in superficial characters (especially those of scales and setae) in the lowland environment, *A. e. ebrius* closely resembles *A. c. cornutus* and has been confused with it by all previous workers except Faust, whose description has been overlooked. *A. c. cornutus* can usually be distinguished by its less convex eyes but single specimens, especially females, may have to be checked by dissection; indeed, one female of *cornutus* from Bisianumu has eyes fully as convex as typical *ebrius*. The size-ranges of these two taxa overlap widely but when good series are examined, a pronounced difference in size is apparent. Thus, a series of *cornutus* from Yule I. measured:

♂: 7·3–9·7 ($\bar{x}$ (25)=8·5); ♀: 7·8–9·9 ($\bar{x}$ (25)=9·0) mm,

while a series of *ebrius* from Lae (Singuawa River) measured:

♂: 6·3–8·3 ($\bar{x}$ (25)=7·1); ♀: 7·1–8·8 ($\bar{x}$ (25)=7·8) mm.

A. e. ebrius is the commonest, most widespread and most important member of the genus; if Faust's name be taken to mean 'plentiful', it could scarcely be more appropriate.

Among the various upland forms there are two, both peripheral (but not isolated), which differ so strongly from the rest as to demand formal recognition. They are described hereunder as subspecies.

Apirocalus (Apirocalus) ebrius wagneri subsp. n.

(Figs 14, 71, 72, 193, 194, 203, 204; Map 5)

Range. Northern Morobe District. Altitude: 1200–1920 m.

Length, ♂: 6·7–8·5 mm; ♀: 7·6–9·6 mm. Differs from upland forms of the nominate subspecies as follows. Elytral processes of ♂ (Fig. 71) narrower, often set closer together, terete and strongly tapering (hence with narrower apical fringe), sometimes steeply rising or curving laterad; sides of elytra distinctly narrowed in front of process bases, making elytra appear more elongate; EPI 133–147 (♂), 108–120 (♀); scales on femora mostly small and separate, often pearly or coppery, contrasting with grey-green scales on body; strial granules larger in both sexes, usually at least as large as surrounding scales; antennal club larger, ×0·30–0·35 as long as pronotum; funicle segments rarely with any scales; scales usually present on segments 1 and 2 of hind (and sometimes middle) tarsi; setae on postero-ventral margin of pronotum of ♀ often reduced or absent; flagellum longer (on average).

Genitalia (Figs 193, 194, 203, 204).

Holotype ♂, PAPUA NEW GUINEA: [Morobe District, Huon Peninsula], Komba (*L. Wagner*), in SAM.

Paratypes. PAPUA NEW GUINEA: 12 ♂, 10 ♀, same data as holotype (16 SAM, 6 BMNH); 8 ♂, 4 ♀, Cromwell Range, vii.1929 (*L. Wagner*) (9 AMNH, 3 BMNH); 1 ♂, Finsch Haven [Finschhafen], Wareo (*L. Wagner*) (SAM); 4 ♂, 2 ♀, Salawaket [Saruwaged] Range, Baindoang, 1800 m, 15.ix.1956 (*E. J. Ford, Jr*) (3 BPBM, 3 BMNH); 2 ♂, 3 ♀, Sepalakambang, 1920 m, 11–14.ix.1956; 1 ♂, 1 ♀, Gewak, 1530 m, 7.ix.1956; 1 ♂, Baindep, 1260 m, 16.ix.1956 (all *E. J. Ford, Jr*) (all BPBM); 9 ♂, 5 ♀, Finisterre Range, Saidor, Funyende, 1200 m, 24 and 24–30.ix.1958 (*W. W. Brandt*) (10 BPBM, 4 BMNH); 2 ♂, 1 ♀, Saidor, Matoko [1500 m], 6–24.ix.1958 (*W. W. Brandt*) (BPBM).

Specimens examined: 67; dissected: 23 (16 ♂, 7 ♀).

Doubtful records. The specimen labelled 'Wareo, Finsch Haven' in the above list almost certainly came from the inland ranges. Two males labelled 'Neu-Pommern / coll. Plason' undoubtedly belong to this subspecies but I do not believe that it occurs in New Britain.

Local variation. Although the Funyende specimens have the main distinguishing characters of this subspecies (their strial granules are even larger than those of the other paratypes), the females have normal setae on the postero-ventral margin of the prothorax and the flagellum of the male is shorter, ×3·5–4·0 as long as pronotum (×4·3–4·9 in the other series). Also the spermathecae from two Komba specimens have distinct gland-lobes, whereas those from Funyende

do not. These differences indicate that the Funyende population is, to some extent, intermediate between this subspecies and the nominate. The latter occurs in the vicinity of Funyende but mostly at lower altitudes.

This subspecies bears a strong superficial resemblance to *A. atrigenua* which occurs in the same area (at higher altitude); the latter may be distinguished by its more slender antennal scape, more strongly convex eyes, (mostly) dark femoral setae and flattened or depressed pronotal disc.

Apirocalus (Apirocalus) ebrius angustus subsp. n.

(Figs 69, 70, 191, 192, 202; Map 5)

Range. Eastern Highlands and Chimbu Districts. Altitude: 1500–2000 m.

Length, ♂: 6·3–7·6 mm; ♀: 7·3–8·4 mm. Differs from upland forms of *A. e. ebrius* as follows. Elytral processes of ♂ (Fig. 69) set closer together, less strongly diverging, their inner margins straighter, outer halves strongly depressed, forming a thin flange which is distinct from thick inner half of process; processes of ♀ (Fig. 70) shorter and more strongly diverging, either blade-like, with broad fringe (resembling ♂ of lowland form of *A. e. ebrius*) or more strongly tapering (but with distinct outer edge); EPI 142–158 (♂), 130–148 (♀); elytral suture narrowly and very sharply raised on declivity in ♂ and sometimes in ♀ (not, or bluntly raised in *A. e. ebrius*); strial punctures smaller, granules always very small; scales smaller, mostly contiguous rather than imbricate, those on distal half of processes and disc of ventrites 1 and 2 more strongly ovate or elongate; setae on postero-ventral margin of prothorax of ♀ fewer and smaller (shorter than segment 3 of antennal funicle).

Genitalia (Figs 191, 192, 202).

Holotype ♂, Papua New Guinea: 'Bismarck Gbg, Waghital' [? Wahgi valley], 5000–7000 ft [1500–2100 m], 1963 (*C. Voss*), in MGF.

Paratypes. Papua New Guinea: 4 ♂, 4 ♀, same data as holotype (5 MGF, 3 BMNH); 3 ♂, 2 ♀, Eastern Highlands, Mt Michael, Lufa, Frigano Road [1800 m], 9.iii.1974 (*R. W. Hornabrook*) (4 RWH, 1 BMNH); 3 ♂, South Fore, Lamari River, 28.xi.1963 and 28.iii.1964 (RWH).

Specimens examined: 17; dissected; 9 (7 ♂, 2 ♀).

Bionomic data. 'On acacia in grassland' (Frigano Road).

The range of this subspecies is uncertain. The type-locality is possibly near Omkalai (Chimbu District, 20 km S. of Kundiawa) since the Wahgi River crosses the 7000 and 5000 ft contours just north of it. Such a location would be congruent with the record for Mt Michael but leaves that for Lamari River somewhat isolated.

A very extraordinary specimen in DAPM (Kainantu, Arona, 25.i.1964) is undoubtedly female but has elongate, flattened, very weakly diverging and steeply rising elytral processes with entirely whitish fringing setae.

Some specimens of the nominate subspecies from adjoining localities, notably Goroka, Kainantu and Aiyura, bear a superficial resemblance to *A. ebrius elongatus*, even to having elongate elytral processes in the female but such females have large setae on the postero-ventral margin of the prothorax and normal scales on the elytral processes and venter; many normal specimens are known from these localities.

It is a singular fact that both the above subspecies, which represent quite different extremes of variation within the *ebrius*-complex, show a marked reduction in size of the prothoracic setae which are otherwise characteristic of the female sex throughout the *cornutus*-group (except *A. paradoxus*).

Apirocalus (Apirocalus) hornabrooki sp. n.

(Figs 68, 195, 196, 205; Map 5)

Range. Madang District (Karkar I.). Altitude: *c.* 1500 m.

Length 8·2–11·2 mm. Entirely black; femora, antennal funicle and tarsal claw-segments sometimes slightly reddish; scales dense, pale greyish or brownish (stained ?). Otherwise differs from *A. cornutus*

virescens as follows: scape slightly longer, ×0·9–1·0 as long as pronotum (×0·8–0·9 in *A. c. virescens*, longer, on average, in ♀ in each case) but similar in width, hence more slender; eyes slightly smaller but of similar convexity; scales on legs as large as those on elytra, matt, mostly pale bluish grey (not smaller and coppery), those on vertex of head and antennal scape also bluish; scales in middle of metasternum and venter almost as large and dense as those near sides; tarsi with, at most, a few small scales on segments 1 and 2 of middle and hind tarsi; sides of elytra (Fig. 68) narrower at process bases, planes of processes less strongly tilted inwards; processes of ♀ right-angled, their spread slightly less than greatest width of elytra proper; EPI 143–152 (♂), 114–116 (♀).

Genitalia. Median lobe of aedeagus (Figs 195, 196) half as long as pronotum and ×2·6–3·0 as long as broad; struts ×2·4–2·7 as long as median lobe and ×1·3–1·5 as long as pronotum; flagellum ×2·5–2·7 as long as pronotum (two observations), basal sclerite with spur; internal sac with unpigmented denticles. Spermatheca (Fig. 205) slender; tail as long as or longer than body, strongly reflexed, tapering; gland-lobe obsolete; gland slender; duct very long (not measured).

Holotype ♂, PAPUA NEW GUINEA: [Madang District], Korker [Karkar] I., crater rim [*c.* 1500 m], 25.iii.1972 (*R. W. Hornabrook*), in BMNH.

Paratypes. 6 ♂, 3 ♀, same data as holotype (6 RWH, 2 BMNH, 1 BPBM).

Specimens examined: 10; dissected: 5 (3 ♂, 2 ♀).

In spite of its large size, the long flagellum and spermathecal duct show clearly that this species is related to *A. ebrius* rather than to *A. cornutus*.

The *strigifrons*-group

Apirocalus (Apirocalus) strigifrons sp. n.

(Figs 211, 212, 233; Map 6)

Range. Morobe District. Altitude: 2070–(?) 2800 m.

♀. Length 7·3–8·3 mm. Black, femora and tibiae red. Scales generally small, separate, dull brown or greenish (not imparting any colour to cuticle) with some larger, brighter green scales either scattered or in small groups; elytral declivity with much larger scales, of various colours, forming a pale transverse band between elytral processes. *Head* with frons moderately declivous, entirely covered with strong, ± regular rugae but without any median carina; eyes moderately convex (about as in *A. ebrius*); scales very small, mostly brown, confined to grooves between rugae with a few larger scales below eyes; setae above and below eyes small, fine, mostly white. *Rostrum* ± parallel-sided, pterygia very slightly wider than genae; upper surface ± flat, distinctly narrowed behind antennal insertions and there strongly and irregularly rugose, seldom with a distinct median carina; scales as on frons; setae white. *Antennae* with funicle segments 1 and 2 subequal, 3–6 subequal and about half as long as 2, 7 usually (but not always) distinctly longer than 6 and ×1·2–1·7 as long as broad; club ovate, ×2·2–2·3 as long as broad and ×0·3 as long as pronotum; scape stout, weakly sinuous, strongly flattened, ± parallel-sided in distal two-thirds, apex strongly capitate, the expansion asymmetrical, greatest anteriad; upper surface with strong rugulae and scattered lipped punctures; setae mostly stouter than those on funicle, moderately curved, semi-erect, mostly white along leading edge, mostly brown elsewhere, the longest distinctly shorter than greatest diameter of scape in middle of length; scales mostly green, mostly confined to grooves between rugulae; funicle segments with very sparse recumbent silky hairs. *Prothorax* slightly longer than broad, widest about middle, sides moderately rounded apicad, weakly rounded basad, without any constriction; disc of pronotum flat, flattened area well defined (at least at sides), either quite flat or with ill-defined cariniform elevations in mid-line in anterior half and near base; surface very finely granulate, sometimes with scattered larger granules; sides finely and irregularly rugose; scales on disc no larger than those on scape, separate and inconspicuous; scales on sides much larger, often bright green, especially on lower part of sides; setae on sides similar to those on scape but subrecumbent, usually brown and inconspicuous. *Elytra* cordate, ×1·1–1·2 as long as broad, sides strongly rounded near base; disc ± flat, flattened area ending ± abruptly in interstria 5; declivity steep; suture weakly but sharply raised on declivity and posterior half of disc; surface of elytra shagreened and with scattered microgranules which sometimes coalesce to form minute transverse rugulae; striae not or weakly impressed; strial punctures well defined but very small (scarcely larger than largest surrounding scales); strial granules about as large as strial punctures and each with a small brown seta projecting posteriad across puncture; interstrial granules similar to strial granules but fewer and bearing much larger setae, some of those near sides longer than those on scape; elytral processes subhorizontal (dorsal surface ± in line with that of elytra proper), elongate, evenly

tapering, somewhat flattened but terete, weakly diverging, so that spread is less than greatest width of elytra proper (sometimes much less); apex narrowly rounded, asymmetrical, fringing setae mostly brown or blackish, longest about equal to greatest width of hind femora (in dorsal view), often spreading over upper surface of process; EPI 133–142. *Mesepisterna* and arms of mesosternum with a few large punctures, a few scales and a few small setae. *Mesosternum* with large but separate scales (subcontiguous towards sides but not imbricate); ventrites 1 and 2 with much smaller, well separated scales; ventrites 3–5 with even smaller, sparser, scales; setae throughout very fine, hyaline or brownish. *Legs* with femora moderately swollen; fore and middle tibiae straight or weakly incurved very near apex, hind tibiae straight; hind tarsal claw-segment ×2·0 as long as segment 3; scales green, mostly small and well separated but larger and sometimes subcontiguous on widest part of femur, those on tibiae sometimes subcontiguous along outer (dorsal) edge; setae on femora and tibiae fine, pale, shorter on average than those on scape, those on knees arising from small granules; setae on tarsi all very pale; segments 1 and 2 of hind tarsi with an occasional elongate scale among the recumbent hairs.

Genitalia. Spermatheca (Figs 211, 212) with tail about as large as body, body curving 'dorsad' and merging with tail in an even curve; gland-lobe distinct, variable, gland claviform or pedunculate; duct-lobe large, variously flexed, two-thirds length of body; duct several times overall length of spermatheca; styli of ovipositor ×4·4 as long as broad.

Holotype ♀, Papua New Guinea: Morobe District, Bulldog Road, *c.* 14 km S. of Edie Creek, 2405 m, 4.v.1969 (*J. Sedlacek*), in BPBM.

Paratypes. Papua New Guinea: 1 ♀, same data as holotype except 4–10.vii.1966 (*G. A. Samuelson*); 1 ♀, Bulldog Road, 40 km S. of Wau, 2100–2800 m, 22–31.v.1969 (*J. Sedlacek*) (both BPBM); 1 ♀, Bulldog Road, 60 km S. of Wau, 2070 m, 22–31.v.1969 (*J. Sedlacek*) (BMNH).

Specimens examined: 4; dissected: 3 (♀).

A distinctive species, clearly related to the *olivaceus*-group but distinguished from it by the broad, strongly capitate antennal scape and the elongate seventh funicle segment. The scape is similar to that of *A. acutus* but these two species have little else in common.

The *acutus*-group

Apirocalus (Apirocalus) acutus sp. n.

(Figs 18, 19, 207–210, 241; Map 6)

Range. Morobe District. Altitude: 1200 (?)–2350 m.

Length 9·5–10·0 mm. Black, antennae, femora and tibiae reddish black; scales bright orange-brown and/or pale green with variable admixture of brown or blackish scales; scales on declivity not paler than elsewhere. *Head* with frons weakly declivous, ± distinctly rugose and with trace of median carina; eyes moderately convex (about as in *A. cornutus*); scales small, contiguous but not concealing frontal rugae; setae very fine and inconspicuous. *Rostrum* as elongate as in *A. cornutus*; sides tapering to middle, widening again at genae; pterygia slightly wider than genae, their rims microreticulate in both sexes; dorsal surface ± flat, distinctly narrowed behind antennal insertions, with a distinct (♂) or very stout (♀) median carina; dorsal surface and genae with ± contiguous scales and mostly white setae. *Antennae* dimorphic (see below); scape sinuous, strongly capitate, apex truncate; setae on leading edge sparse, erect or semi-erect, brown and white, as fine as those on funicle, not exceeding greatest width of scape in middle of length; funicle segments with very fine recumbent silky hairs but no scales; club ×0·3 as long as pronotum. *Prothorax* distinctly longer than broad in ♂, slightly longer in ♀, widest in or slightly in front of middle, tapering or weakly constricted basad, weakly to moderately rounded apicad; sides of disc of pronotum strongly raised, the elevations clearly defining an ovate, flat or weakly concave area, extending for almost entire length of pronotum and about three-quarters of its width; sculpture and vestiture as in *A. olivaceus*. *Elytra* < ×1·4 as long as broad in ♂, ×1·3 as long in ♀, strongly dimorphic (see below); strial punctures very small or obsolete on disc, distinct on sides but often concealed by scales; strial and interstrial granules similar, ± scale-size and with minute setae throughout in ♂; setae near sides larger in ♀ but smaller than those on leading edge of scape; top of declivity with a prominent scale-free band, extending along processes to near apex. *Mesepisterna* with cluster of punctures, scales and small setae in posterior half; arms of mesosternum bare, sometimes with a few punctures. *Metasternum* and ventrites 1 and 2 with contiguous or narrowly separated scales, similar to those on elytra; ventrites 3–5 with sparser, smaller scales; setae fine, whitish or brownish. *Legs* with femora weakly to moderately

swollen, with mostly narrowly separated scales, smaller than those on elytra; setae white, semi-erect, a little shorter and stouter than those on leading edge of scape; tibiae rugulose, with scales similar to those on femora and semi-erect, brownish setae; tarsi with few recumbent silky hairs and no scales; hind tarsal claw-segment × 1·8 as long as segment 3 in ♂, × 2 as long in ♀. *Sexual dimorphism* strong, affecting antennae (Figs 18, 19) and legs, as well as elytra. Antennae of ♀ stouter than those of ♂ in all their parts; funicle of ♂ normal, segments 3–7 longer than broad (7 only slightly longer); ♀ with segment 3 slightly longer than broad but segment 4 quadrate and 5–7 increasingly broader than long (10: 11, 10: 13, 10: 14), 6 and 7 chestnut-shaped and pressed close together; club of ♂ elongate, × 3 as long as broad but in ♀ stouter, × 2·3 as long as broad; scape of ♂ slender, widening gradually from base to apical expansion which projects anteriad in form of a triangle; scape of ♀ stouter, widening more strongly apicad, anterior part of apical expansion taking the form of a hook. Legs of ♂ with fore femora strongly arched in basal third, middle and hind femora very weakly arched; fore femora of ♀ weakly arched, middle and hind femora straight; fore tibiae of ♂ very strongly and rather abruptly incurved in apical third but fore tibiae of ♀ less strongly and more evenly incurved. Elytra of ♂ narrow, sides almost straight, disc almost flat, apex simple; processes short, angular, mesal (posterior) margins straight or concave, making a very obtuse angle with each other, outer margins convex, with sharp edges which continue (less sharply) along sides almost to base; elytra of ♀ convex, rounded at sides, apex narrowly but deeply emarginate; processes very short, rounded, narrower than elytra proper, projecting feebly posteriad, their outer edges produced as a tectiform carina across disc of elytra in direction of eye of opposite side, stopping short at level of metasternum.

Genitalia. Median lobe of aedeagus (Figs 208–210) × 0·8 as long as pronotum and × 3·7 as long as broad, strongly curved and with elongate apical region; struts × 1·4 as long as median lobe; flagellum small, *c.* × 0·4 as long as median lobe and *c.* × 0·3 as long as pronotum (one observation, specimen defective); part of internal sac with double row of large brown denticles. Spermatheca (Fig. 207) similar to that of *A. cornutus*; duct about × 2·5 overall length of spermatheca; styli of ovipositor × 3·5 as long as broad.

Holotype ♂, Papua New Guinea: Morobe District, Mt Kaindi, 16 km S. of Wau, 2300 m, 8–9.vi.1962 (*J. Sedlacek*), in BPBM.

Paratypes. Papua New Guinea: 1 ♀, Mt Kaindi, 2350 m, 30.iv.1966 (*J. L. Gressitt*) (BPBM); 1 ♂, Wau, 1200–1300 m, 6.vi.1962 (*J. Sedlacek*) (BMNH).

The Wau male was originally intended to be the holotype and has not, therefore, been dissected. The other, dissected, male has been chosen instead because I am not entirely convinced that the Wau record is genuine.

A bizarre species, exhibiting several unique features, notably the curvature of the fore femora of the male and the transverse funicle segments of the female. I have placed it near the *olivaceus*-group on account of its elongate aedeagus and the similar sculpture of the prothorax.

The *olivaceus*-group

Elytral processes variable but without any discrete swelling at base. Surface of elytra behind shoulder region often flattened or depressed; striae on disc often non-parallel. Entire upper surface of prothorax ± uniformly ruguloso-granulate, the granules usually no larger than those on base of elytra, often ill-defined or confused; a large part of disc usually flattened or depressed; traces of a narrow median carina often present. Rostrum parallel-sided; pterygia reduced, at most as wide as genae; upper surface usually evenly transversely convex throughout. Antennal scape (Fig. 15) straight (beyond basal third), ± flattened but slender, widening very gradually to apex, without any apical expansion or pre-apical constriction; setae erect or semi-erect, usually brown, shorter than those on funicle and almost as fine; funicle segments with sparse recumbent silky hairs and no scales; club fusiform, × 0·27–0·34 as long as pronotum. Mesepisterna densely squamose, at least posteriorly; arms of mesosternum with or without scales. Median lobe of aedeagus variable, × 2·9–5·9 as long as broad; flagellum long, × 1·5–3·2 as long as pronotum. Spermatheca variable; styli of ovipositor × 3–4 as long as broad.

A well defined group of montane species, occupying almost exactly the same range as the *avus*-group. The female of one species (*A. stellifer*) has the large prothoracic setae and smooth pterygial rims characteristic of females of the *cornutus*-group. The traces of a median carina on the pronotum have a parallel in the closely-related genus *Hellerrhinus* Marshall. All four species are new.

Apirocalus (Apirocalus) stellifer sp. n.

(Figs 213, 220, 221, 237; Map 6)

Range. Eastern Highlands and Morobe District (Wau). Altitude: 1200–*c.* 2000 m.

Length, ♂: 6·7–7·1 mm; ♀: 7·5–8·3 mm. Black, legs and antennae dark red (tarsi blackish); scales mainly bright rust-brown or olive with a pearly or creamy white blotch on disc of elytra and another on declivity (Fig. 237). *Head* and *rostrum* as in *A. olivaceus* except frons always gently declivous and sides of rostrum parallel or weakly widening at genae (never tapering apicad). *Antennae* with funicle and club as in *A. olivaceus*; scape stouter, upper surface more distinctly rugulose and with larger setae, those on leading edge mostly distinctly longer than width of funicle segments and usually pale or reddish brown. *Prothorax* as long as broad or slightly longer (especially in ♂), sides weakly to moderately rounded, without any pre-apical constriction; disc of pronotum broadly flattened but not (transversely) depressed, sculpture as in *A. olivaceus* except rugulae not radiating, granules in centre even less distinct and traces of median carina usually more extensive; scales contiguous (between granules, etc.) and not, or very slightly, larger on sides than on disc, often imbricate and paler towards hind angles; setae larger (similar to those on scape) but concolorous with scales, hence inconspicuous. *Elytra* similar to those of *A. olivaceus* but sides of upper surface more strongly and extensively depressed; striae less distinct, often obscured by scales or their punctures lacking associated granules (especially on disc between pale blotch and processes); interstrial granules more irregular and often larger than strial granules, especially in depressed areas (but absent from posterior part of disc); scales generally contiguous or subcontiguous but those composing pale discal blotch strongly imbricate and merging all round (except where produced anteriad along interstria 1) with dense or imbricate usually bright rust-brown scales which extend posteriad along interstriae 1–3 and on to process bases; between process bases and separating bright brown scales from pale declivital patch is a ± scale-free zone, glossy black on elytra proper and finely shagreened where it extends along inner sides of processes; setae on elytra proper of ♂ as in *A. olivaceus* but much larger in ♀, especially conspicuous around elytral apex where longest is as long as segment 2 of hind tarsi; setae in process fringes paler and somewhat shorter in ♀ than in ♂. *Mesepisterna*, etc., as in *A. olivaceus* except arms of mesosternum more extensively squamose. *Metasternum* with large round imbricate scales at sides, rapidly becoming much smaller, ovate and separate towards middle and on mesosternal process; venter almost entirely with such scales and with smaller, pointed, or even linear ones; setae fine, semi-erect and pale, those on ventrites 3 and 4 arranged in a single transverse row on each. *Legs* with femora strongly swollen; tibiae more strongly incurved towards apex in ♂ than in ♀, not sinuous; scales on swollen part of each femur contiguous or imbricate, ± concolorous with those on elytra but whitish and strongly imbricate below swelling and grading to pearly white on meso-dorsal aspect (especially on middle femora); setae mostly white, larger and, in general, more nearly erect in ♀ than in ♂. *Sexual dimorphism* strong; ♀ larger than ♂ and with larger clothing setae (see above); elytral processes of ♂ elongate, base conical, narrowly drawn out, flattened only towards apex and only there with a distinct edge; processes of ♀ as in *A. olivaceus* but usually sharper and with interstria 5 not raised in front of process; EPI 131–138 (♂), 114–120 (♀); ventrite 5 as in *A. olivaceus*; postero-ventral margin of prothorax of ♀ with a row of very long sub-erect setae (as long as width of a trochanter) and rims of pterygia smooth (cf. *cornutus*-group); rims of pterygia of ♂ microreticulate and prothorax without such setae.

Genitalia. Median lobe of aedeagus (Figs 220, 221) similar to that of *A. olivaceus* but slightly less elongate, × 0·6 as long as pronotum and × 2·9–3·3 as long as broad; struts × 1·8 as long as median lobe, manubrium shorter than median lobe, flagellum × 4·9–5·7 as long as median lobe and × 2·9–3·2 as long as pronotum (three observations). Spermatheca (Fig. 213) with body swollen and larger than tail; gland-lobe small; duct-lobe much shorter than body; gland claviform.

Holotype ♂, Papua New Guinea: Eastern Highlands, Purosa, 1700 m, 17–25.v.1966 (*Gressitt & Tawi*), in BPBM.

Paratypes. Papua New Guinea: 6 ♂, 2 ♀, same data as holotype (5 BPBM, 3 BMNH); 2 ♂, Purosa, 1700–2000 m, 18.i.1966 (*J. Sedlacek*); 1 ♂, Purosa, 20–26 km SE. of Okapa, 1800–2200 m, 28.viii.1964 (*J. & M. Sedlacek*); 1 ♀, Okapa, Okasa, 1400–1650 m, 16.i.1966 (*J. Sedlacek*); 1 ♂, 13 km SE. of Okapa, 1650–1870 m, 26.viii.1964 (*J. & M. Sedlacek*) (all BPBM); 1 ♂, 1 ♀, Okapa, 11.iv.1971 (*R. W. Hornabrook*) (RWH); 1 ♂, Okapa, *c.* 5000 ft [1500 m], 20.xii.1964 (*R. W. Hornabrook*), B.M. 1965–120 (BMNH); 2 ♂, 1 ♀, Kainantu, 1500 m, 20.i.1966 (*J. & M. Sedlacek*) (BPBM); 2 ♂, 1 ♀, Morobe District, Wau, Hospital Creek, 1200 m, i.1965 (*J. Sedlacek*) (2 BPBM, 1 BMNH); 2 ♂, ditto except 17.ii.1965 (*P. Shanahan*) (BPBM).

Specimens examined: 25; dissected: 6 (4 ♂, 2 ♀).

A very distinctive species with, apparently, a curiously disjunct distribution. Males outnumber females in the above series by $>3:1$.

Apirocalus (Apirocalus) olivaceus sp. n.

(Figs 3, 15, 214–216, 226–232; Map 6)

Range. Western, Southern and Eastern Highlands; Chimbu. Altitude: 2200–3900 m.

Length, ♂: 6·1–8·5 mm; ♀: 6·8–9·2 mm. Black or reddish black, antennae dark red (club black), legs dark red (coxae, knees and tarsi black); scales mainly either green, pearly or brown but dulled by contamination. *Head* with frons not, or only weakly declivous (often in line with rostrum in profile view), its surface marked with irregular rugae, radiating from the deep but narrow rostro-frontal furrow and continuing around eyes to underside of head; eyes strongly convex; scales contiguous (when large) or subcontiguous (when small), densest above and below eyes. *Rostrum* usually parallel-sided, rarely slightly widening apicad but often tapering; apex strongly and evenly rounded in dorsal view; upper surface weakly convex in profile view, merging with epistome and sloping more steeply apicad to a maximum of about 45° with horizontal plane of rostrum, evenly transversely convex throughout; median rostral carina variable, flanked by longitudinal rugae; scales and small white setae present on outer surface of pterygia, in front of eye and on dorsal surface posterior to level of antennal insertions. *Antennae* with funicle segments of equal width, 1 and 2 subequal and *c.* ×3 as long as broad, 3–7 subequal (in large specimens 3 is longest of the five, 4 next longest and 5–7 shorter and subequal), about half as long as 2 and ×1·3–2·1 as long as broad; club fusiform, ×2·6–3·4 as long as broad, stouter in small specimens and females; scape (Fig. 15) with upper surface finely punctured and very weakly rugulose; setae on both edges about equal in length to width of funicle segments, finely pointed, weakly to moderately curved, hyaline or brownish, often weakly iridescent; scales contiguous or separate, about half as large as those on pronotum. *Prothorax* slightly longer than broad in both sexes (rarely slightly broader than long), variable in shape, sides weakly to moderately rounded, sometimes with traces of a pre-apical constriction; disc of pronotum usually broadly depressed, the depression usually fairly well defined, centred on a point about one-third from base, surface usually with fine very irregular rugulae radiating from centre of depression and extending some way beyond it; centre of depression with very small, well defined but often mis-shapen shiny granules which grade peripherally into thickenings on the rugulae which are also exposed between the small, separate or subcontiguous scales; faint traces of a narrow median carina usually present, especially in anterior third and again near base. In some small specimens and some females, the pronotal depression is less well defined (or even absent), the rugulae do not radiate and the granules are larger. Scales at sides of prothorax twice as large as those on disc, dense throughout; setae very small, brown and inconspicuous. *Elytra* ovate, ×1·1–1·3 as long as broad, sides strongly rounded, disc flat or weakly convex in profile view, declivity steep in ♀, subvertical in ♂; surface of disc uneven, area behind shoulder region (interstriae 5 and 6) flattened or depressed, adjacent area (centred on interstria 3) raised (especially in ♂); striae narrowly scale-free on disc and declivity; strial punctures with distinct associated granules, as in *A. avus*; interstriae with a single widely spaced row of smaller granules (scale-size or smaller); striae 2 and 3 usually diverge posteriorly and 1 runs parallel to 2, so that 1 often approaches suture at top of declivity (Fig. 3); scales contiguous or imbricate over greater part of elytra, strongly imbricate (and often paler) along costal margin and on declivity, separate on processes, often with a dull brown band across top of declivity (as in *A. granulicollis*) which contrasts sharply with scales on declivity when these are pale; setae generally small and inconspicuous but larger around apex, those in process fringes mainly red-brown, grading to pearly anteriorly, the longest as long as greatest diameter of hind femur (viewed from above). *Mesepisterna* with a few small scattered punctures, surface uneven, extensively covered with scales which are mostly similar to those on adjacent part of elytra but thin out and become smaller anteriorly, also with a few stiff but recumbent setae; arms of mesosternum with surface even and microreticulate with few, if any, punctures, few, if any, scales and no setae. *Metasternum* densely squamose throughout; ventrite 1 similar anteriorly, scales becoming smaller and sparser posteriorly, very small and scattered on ventrites 3–5; setae fine, semi-erect throughout, forming a single irregular transverse row on ventrites 3 and 4. *Legs* with femora moderately swollen; fore and middle tibiae weakly incurved towards apex, hind tibiae very weakly incurved, fore and hind tibiae often very weakly sinuous; hind tarsal claw-segment usually ×2·1–2·3 as long as segment 3; scales about as large as those on disc of pronotum, often coppery (sometimes with blue or violet reflexions), contrasting strongly with those on elytra, usually separate or subcontiguous but sometimes contiguous on widest part of femora and along outer (dorsal) aspect of tibiae; hind tarsal segment 2 occasionally with a few very small scales; setae larger, on average, than those on scape, weakly curved, pointed, mainly whitish,

between subrecumbent and semi-erect, those on knees arising from distinct granules. *Sexual dimorphism* well marked; elytral processes of ♂ elongate, flattened, with distinct outer edge, strongly diverging and often steeply rising or curving upwards; spread of processes exceeding greatest width of elytra proper; process bases narrower than this; inner margins of processes arising from stria 2, ± straight, angle between them varying from distinctly less than a right angle to distinctly more than a right angle (in antero-dorsal view); processes of ♀ similar to those of *A. avus* (♀) but usually somewhat flattened towards apex and with their inner margins sometimes only making a right angle with each other, outer margins ± continuous with interstria 5, which is often raised anteriad as far as level of hind coxae; EPI 118–134 (♂), 107–123 (♀); ventrite 5 variably foveate in both sexes (sometimes with two distinct longitudinal carinae), posterior margin reflexed ventrad in ♀, making fovea appear larger; rostrum with rims of pterygia microreticulate in ♂, smooth in ♀ but ♀ without large setae along postero-ventral margin of prothorax (cf. *A. stellifer*).

Genitalia. Median lobe of aedeagus (Figs 226–232) ×0·6–0·9 as long as pronotum, ×3·2–4·2 as long as broad, strongly curved towards base, narrowed towards apex which is strongly compressed, forming a thin plate which is reflexed dorsad so that its plane is ± in line with lower side of base; struts ×1·2–2·3 as long as median lobe, manubrium ×0·6–0·9 as long as median lobe, flagellum ×2·6–4·4 as long and ×1·8–3·0 as long as pronotum, strongly curved in basal part but not usually forming a ring. Spermatheca (Figs 214–216) linear, tail as large as or larger than body; gland-lobe distinct, its axis usually subparallel with that of body; duct-lobe about as long as body, about as wide as gland-lobe at base, weakly tapering distad, weakly curved, sinuous or (rarely) sigmoid; duct several times overall length of spermatheca; spout straight, unpigmented.

Holotype ♂, PAPUA NEW GUINEA: Chimbu, Asaro-Chimbu Divide, Marifuanga, 25.iv.1972 (*R. W. Hornabrook*), in BMNH.

Paratypes. PAPUA NEW GUINEA: 5 ♂, 6 ♀, same data as holotype (7 RWH, 4 BMNH); 4 ♂, 5 ♀, ditto except 23.x.1971 (7 RWH, 2 BMNH); 1 ♂, 1 ♀, ditto except iv.1971 (BMNH); 3 ♂, 2 ♀, Asaro-Chimbu Divide, Daulo Pass, 2500, 2800 and 3000 m, 12, 13 and 14.vi.1955 (*J. L. Gressitt*); 1 ♂, 1 ♀, Daulo Pass, 2400 m, 15.v and 7.vii.1963 (*J. Sedlacek*) (all BPBM); 1 ♂, Daulo Pass, iii.1971 (*R. W. Hornabrook*) (RWH); 1 ♂, 1 ♀, ditto except 21.vi.1975 (RWH, BMNH); 1 ♂, Asaro valley, Miramar-Gobavabe, 2000 m, 29.vi.1955; 1 ♂, Upper Chimbu-Kerowagi Divide, 2500 m, 6.vii.1955 (both *J. L. Gressitt*) (both BPBM); 1 ♀, Mt Wilhelm, Pengal River, 9200 ft [2760 m], 16.v–9.vi.1963 (*W. W. Brandt*) (ANIC); 4 ♂, 2 ♀, Mt Wilhelm, 2600–3000 m, 2 and 6.vii.1963 (*J. Sedlacek*); 3 ♂, 2 ♀, Mt Wilhelm, 25[00]–3000 m, 20.v, 30.vi and 4.vii.1966 (*J. L. Gressitt*) (all BPBM); 3 ♂, 1 ♀, Mt Wilhelm, 3900 m, 13–24.ix.1968 (*J. Balogh*) (TM); 1 ♂, Mt Wilhelm, *c.* 8000 ft [2400 m], Station No. 194, 20–23.ii.1965 (*M. E. Bacchus*) (BMNH); 2 ♂, Mt Wilhelm, east slopes, No. 6 Pengagl Camp, 2770 m, 6–7.vii.1959 (*L. J. Brass*), Sixth Archbold Exp. (AMNH); 2 ♂, 2 ♀, Mt Wilhelm, Keglsugl, 10–14.viii.1969 (*J. Balogh*) (TM); 1 ♂, 1 ♀, Keglsugl, 2750 m, 17.v.1966 (*J. L. Gressitt*); 1 ♂, Keglsugl, 2500–2720 m, 1.vii.1963 (*J. Sedlacek*); 2 ♂, Mt Wilhelm, Lake Aunde, 2500 m, vii.1968 (*R. Rice*); 2 ♂, 1 ♀, above Kerowagi, 2300 m, 6.vii.1955 (*J. L. Gressitt*) (all BPBM); 5 ♂, 3 ♀, Western Highlands, Nondugl, 16.xi.1950 [*W. W. Brandt*] (ANIC); 3 ♂, 4 ♀, Lake Sirunki, 2800–2900 and 2550 m, 15 and 17.vi.1963; 1 ♂, 1 ♀, Kepilam, 2420–2540 m, 21.vi.1963 (all *J. Sedlacek*) (all BPBM); 2 ♂, 2 ♀, Southern Highlands, Mt Giluwe, 2550 and 2500 m, 27.v and 6.vi.1963 (*J. Sedlacek*) (2 BPBM, 2 BMNH); 3 ♀, SE. of Mt Giluwe, Dimifa, 2200 m, 10.x.1958 (*J. L. Gressitt*) (2 BPBM, 1 BMNH); 1 ♂, Eastern Highlands, Mt Michael, 2200–2500 m, 20.i.1966 (*J. Sedlacek*) (BPBM); 1 ♀, Okapa, Kamano, 28.i.1973 (*R. W. Hornabrook*) (RWH).

Specimens examined: 92; dissected: 26 (15 ♂, 11 ♀).

A widespread and variable species which reaches higher altitudes than any other in the genus. Specimens from the westernmost localities (Mt Giluwe, Kepilam) are often below average size, have much larger granules on the pronotum and larger scales, even in absolute terms (notwithstanding their smaller body-size) than specimens from the other localities; the median lobe of the aedeagus is shorter in relation to the pronotum while the struts are longer. Although there are females of normal size from these localities, only small males are known from them, so that the significance of the genitalic differences cannot be properly assessed. For this reason, and because the specimens from nearby Lake Sirunki appear to be intermediate, I have refrained from assigning the western specimens to a distinct subspecies. A record for Lake Kutubu (RWH) requires confirmation.

Apirocalus (Apirocalus) tenebricosus sp. n.

(Figs 217, 222–225; Map 6)

Range. Eastern Highlands. Altitude: 1800–2200 m.

Length 7·8–8·6 mm. Differs from *A. olivaceus* as follows. Scales in ♂ much smaller, round or ovate, grey, green, pearly or coppery (with strong blue reflexion), well separated and not imparting any colour to body, which appears dull black to unaided eye; scales in ♀ larger, sometimes as large as in *A. olivaceus* but in mixture of mostly dull colours, usually grey-green or grey-brown, denser and paler on elytral declivity. *Sexual dimorphism* less strong; elytral processes situated slightly further forward, those of ♂ shorter, straighter and steeper, those of ♀ slightly shorter; EPI 107–121 (♂), 105–114 (♀).

Genitalia. Median lobe of aedeagus characteristic (Figs 222–225), at least as long as pronotum; struts as long as pronotum, flagellum × 2·3–2·6 as long (three observations). Spermatheca (Fig. 217) resembles that of *A. olivaceus*.

Holotype ♂, PAPUA NEW GUINEA: Eastern Highlands, Mt Otto, 7.ix.1972 (*R. W. Hornabrook*), in BMNH.

Paratypes. PAPUA NEW GUINEA: 2 ♂, 2 ♀, same data as holotype (3 RWH, 1 BMNH); 1 ♂, ditto except 30.v.197- (RWH); 2 ♂, 1 ♀, south slopes of Mt Otto, Kotuni, No. 7, 2200 m, 9 and 16–19.viii.1959 (*L. J. Brass*), Sixth Archbold Exp. (AMNH); 1 ♂, Asaro valley, Miramar, 1800 m, 27.vi.1955 (*J. L. Gressitt*) (BPBM).

Specimens examined: 10; dissected: 4 (3 ♂, 1 ♀).

Closely related to *A. olivaceus* (females are scarcely separable). The Miramar specimen has steeper elytral processes than the other males and its aedeagus is longer.

Apirocalus (Apirocalus) anatinus sp. n.

(Figs 218, 219, 238; Map 6)

Range. Eastern Highlands. Altitude: 1800 m.

♂. Length 8·5 mm. Differs from *A. olivaceus* as follows. *Antennae* with funicle segment 2 distinctly longer and slightly narrower than 1 (× 4 as long as broad); scape claviform, very slender in basal two-thirds (about as wide as funicle), thickening rather abruptly in distal third; longest setae on leading edge slightly longer than width of funicle and also exceeding greatest diameter of scape in middle of length. *Prothorax* with a section of well developed median carina in anterior third of pronotum and traces of a carina in posterior two-thirds. *Elytra* with processes triangular (apex rounded), plane in line with middle coxa, inner (posterior) margin broadly rounded, vertical, outer margin with sharp edge; processes diverging by about a right angle (in posterior view) and set about mid-way between base and apex of elytra; setae in apical fringes shorter than in *A. olivaceus*, almost all red-brown; declivity elongate, tapering, sloping at about 45° to horizontal; pre-apical callus (at confluence of interstriae 3 and 9) prominent (small or obsolete in *A. olivaceus*); EPI 100.

Genitalia. Median lobe of aedeagus characteristic (Figs 218, 219), × 1·5 as long as pronotum, struts × 0·6 as long as median lobe and × 0·9 as long as pronotum; flagellum × 2·5 as long as pronotum.

Holotype ♂, PAPUA NEW GUINEA: Eastern Highlands, Aiyura, 6000 ft [1800 m], 11.vii.1962 (*J. H. Barrett*), in BMNH.

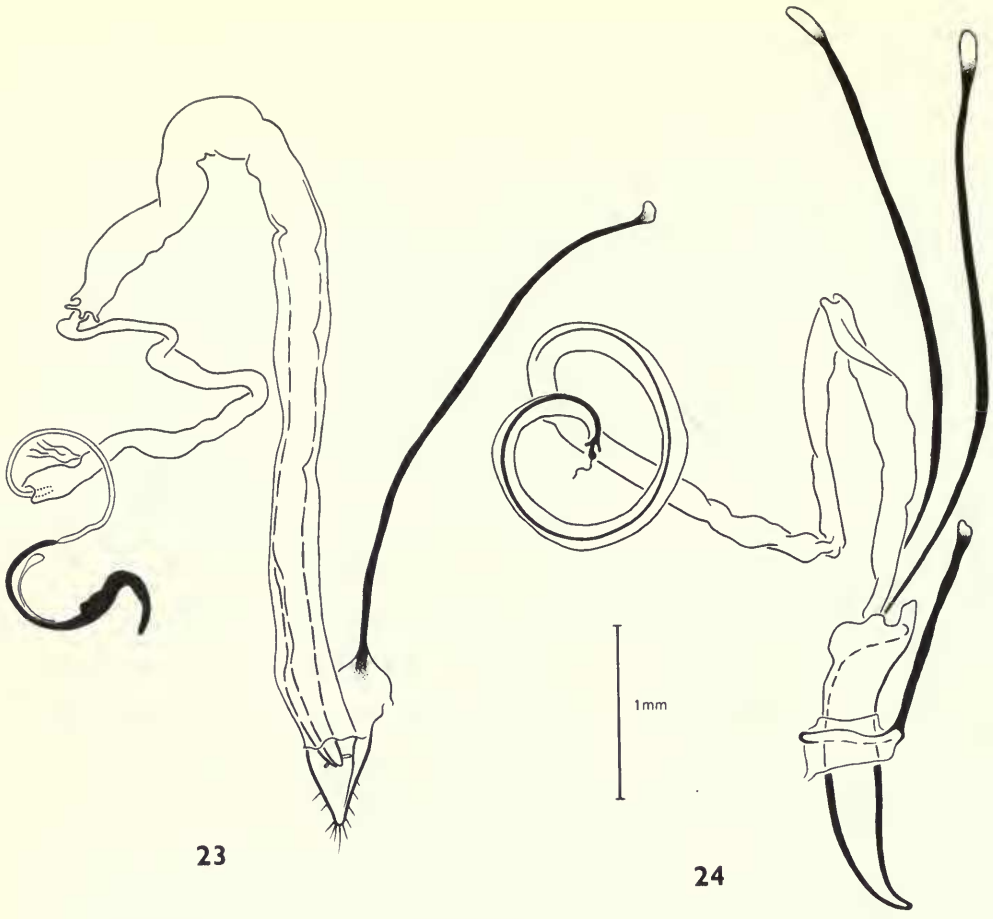
Bionomic data. 'x moss x forest'.

A very distinctive species which also has the longest known aedeagus in the genus and the only one that is longer than its struts. The name derives from a fancied resemblance of the specimen to a duck in flight.

ALBERTISIUS gen. n.

Type-species: *Apirocalus gestroi* Pascoe (Fig. 242).

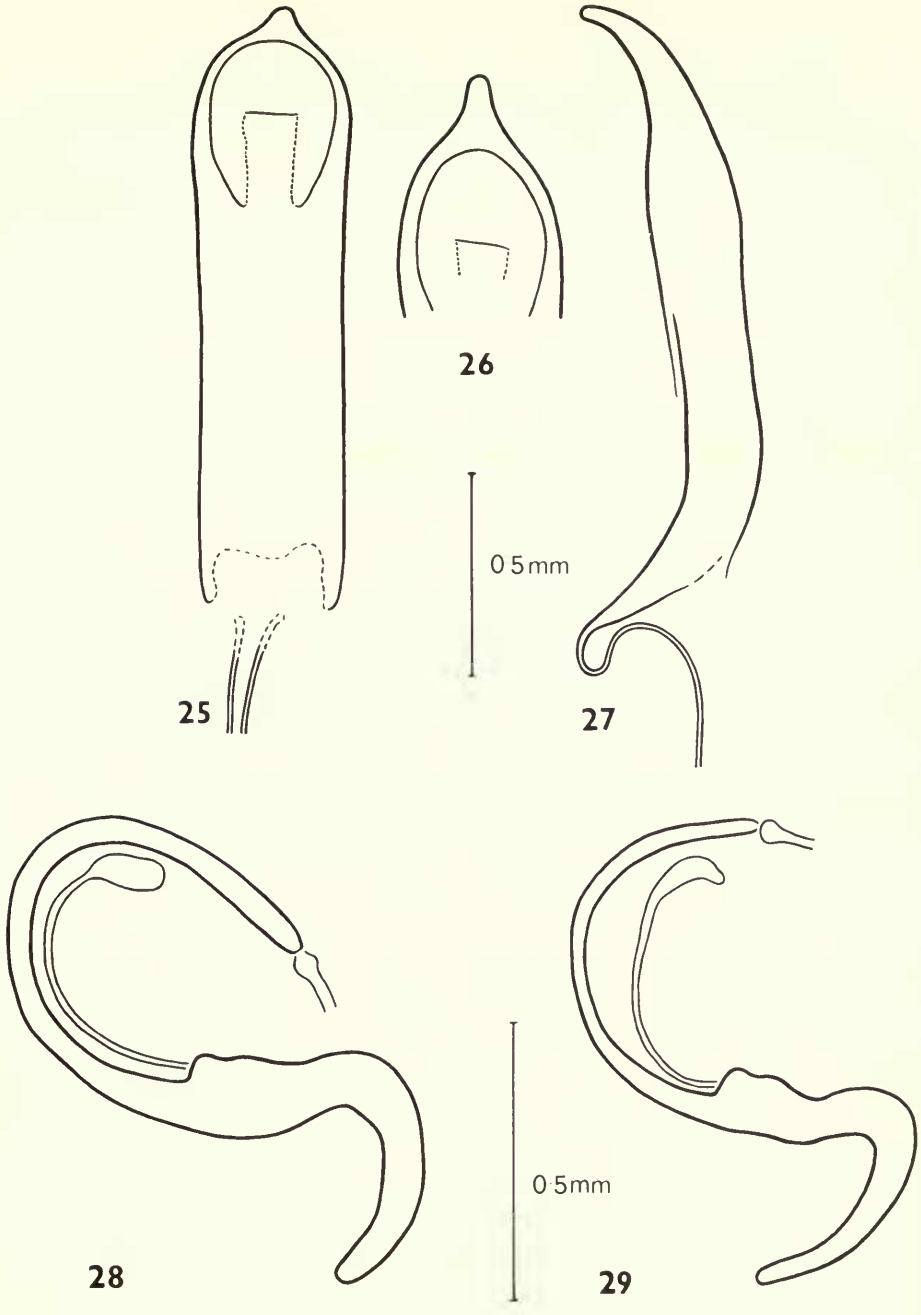
Celeuthetine Curculionidae (*sensu* Marshall, 1956 : 5) with head constricted behind eyes; eyes strongly convex, undercut on dorsal and posterior aspects and projecting slightly over post-ocular constriction. Rostrum strongly widening at pterygia; dorsal surface explanate above antennal insertions, strongly



Figs 23, 24 *Albertisius* species, genitalia. 23, *excellens* ♀; 24, *gestroi* ♂.

narrowing towards middle, thence evenly widening to base; width above antennal insertions equal to, or greater than width at base and width of frons between eyes; apical region weakly and smoothly or strongly and rather abruptly declivous; mentum with two setae. Frons separated from rostrum by a deep V-shaped furrow, the two limbs of which are almost separated by narrow tip of otherwise broad and flat (fusiform) median rostral carina. Antennal scape about as long as pronotum, slender, terete, widening gradually from base, densely squamose; funicle segments with recumbent silky hairs but no scales; segments 1 and 2 subequal. Prothorax slightly longer than broad, apex distinctly narrower than base, convexity along mid-line very similar to that at sides; almost entire surface covered with large deep close-set punctures whose interspaces form a fairly regular reticulum, usually without granules. Scutellum absent. Base of elytra sharp and slightly raised; 10 striae, 10 approached by 9 at level of hind coxae and thence very tenuous; sides (interstriae 5–6) produced horizontally and laterad to form a carina or process fringed with setae. Fore coxae narrowly separated, partly squamose; middle coxae with or without scales; trochanters without a single large seta; tarsi with recumbent lanceolate setae but no true scales. Intercoxal process of mesosternum about as long as broad; arms of mesosternum and mesepisterna squamose. Ventrites 3 and 4 squamose; ventrite 5 weakly foveate in both sexes; hidn tibiae of ♂ swollen or not.

Genitalia (Figs 23–29) similar to those of *Apirocalus* except aedeagal struts of ♂ with strong S-shaped flexure at base (Fig. 27) and spermatheca of ♀ with duct-lobe much longer (× 3 as long as body of spermatheca) and strongly recurved 'dorsad' (Figs 28, 29); flagellum of ♂ short and less strongly tapering than those of comparable length in *Apirocalus*; short section of internal sac near anterior end lined with very dense sharp weakly pigmented denticles.



Figs 25–29 *Albertisius* species, genitalia. Aedeagus of *A. gestroi* in (25) dorsal, (26) posterodorsal and (27) right lateral view. 28, 29, spermathecae of *A. excellens*.

Albertisius differs from *Heteroglymma* (Celebes) in having only ten elytral striae; from *Apirocalus* and *Kokodanus* in having only two setae on the mentum and the rostrum at least as wide above antennal insertions as frons between eyes; from *Hellerrhinus* in having a post-ocular constriction and strongly punctured prothorax; from *Peteinus* (Misima I.) in having only two setae on the mentum and the pronotum punctate, not granulate. Its closest relative appears to be *Cyphopus* which also has two setae on the mentum, a strongly punctured pronotum and sometimes broad lateral elytral processes. *Cyphopus* differs from *Albertisius*, however, in having a stouter scape, the prothorax almost as wide at apex as at base (Marshall, 1956 : fig. 43), the rostro-frontal furrow weakly curved instead of sharply angulate and the two anterior pairs of femora deformed.

Congeneric with *A. gestroi* is *Idiopsis excellens* Faust (Marshall, 1956 : fig. 32); both species agree closely in the structure of the head, rostrum and antennae, shape and sculpture of the prothorax and in the male genitalia. They both have a pair of broad elytral processes which are horizontal and arise from the sides of the elytra rather than from the declivity, as in *Apirocalus*. The apex of the rostrum dorsally is weakly declivous in *A. gestroi* but more strongly and sometimes rather abruptly so in *A. excellens* (Faust) **comb. n.** The two species therefore separate at the first couplet in Marshall's key (1956 : 9); neither will run out in it.

I here propose *Idiopsodes* **nom. n.** for *Idiopsis* Faust, 1897 *nec* Brauer & Bergenstamm, 1889 (Diptera).

Albertisius excellens (Faust) differs from *Idiopsodes griseus* (Faust) **comb. n.** (type-species of *Idiopsodes*) in having more strongly convex, posteriorly undercut eyes, a deeper rostro-frontal furrow, a distinct median rostral carina and a wider rostral apex. In *I. griseus*, the dorsal surface of the rostrum is uneven, often with a narrow median furrow but no carina; it is narrower above the antennal insertions than it is at base; the mentum has several small setae in addition to the two principal ones; the elytra are subglobose, with no trace of processes or tubercles; striae 9 and 10 are similar and roughly equidistant throughout their length.

The two species of *Albertisius* may be distinguished thus:

1 Elytral processes truncate (♂) or acuminate (♀) and confined to middle third of elytra. Hind tibiae of ♂ unmodified. Scales green, uniformly distributed. Length 6·0–8·5 mm. Apex of median lobe of aedeagus broadly rounded, without any median projection. (Central District, around Port Moresby) ***excellens*** (Faust)

– Elytral processes cariniform, extending into posterior third of elytra (♂). Hind tibiae of ♂ swollen and with dense stiff setae. Scales white, forming a pattern (Fig. 242). Length 7·0–9·2 mm. Apex of median lobe of aedeagus mucronate (Fig. 26). (Central District, Yule I.) . ***gestroi*** (Pascoe)

It is a very odd fact that all 26 specimens of *A. gestroi* that I have examined (7 MNHN, 6 BMNH, 6 SMT, 6 IP, 1 NMNH) are males; there are a further 27 specimens in the Genoa Museum (von Hayek, pers. comm.) so perhaps a female will be found among these. With a few possible exceptions, all the specimens were taken on Yule I. in May 1875 by the intrepid Italian explorer, L. M. D'Albertis. The exceptions are four specimens from Faust's collection (SMT) labelled 'N. Guinea / Doria' (Faust MS) and a specimen from the Bovie collection (NMNH) labelled 'Nov. Guinée'; 'Heller' (Bovie MS). The record published by Voss (1958 : 209) of specimens from Yule I. taken by L. Biró between 1897 and 1900 refers to *Apirocalus cornutus*. Whether all the known specimens of *A. gestroi* were collected by D'Albertis, or not, the fact remains that I have seen no other definite records of this species. This situation contrasts with that of *Apirocalus cornutus*; D'Albertis took over 250 specimens on Yule I. in April–June 1875 but, unlike *A. gestroi*, it has been recorded there subsequently, both in 1933 and in 1974.

Albertisius gestroi was transferred from *Apirocalus* to *Heteroglymma* by Marshall in 1938 (: 96) but returned by him to *Apirocalus* (without comment) in 1956 (: 17).

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Material totalling some 6430 specimens was assembled for study. Apart from small but valuable collections made by Miss L. E. Cheesman (1934) and M. E. Bacchus (1964), almost the whole of

this material was obtained on loan from the institutions listed on p. 193 through the kindness of their curators: Dr Lee H. Herman, Jr (AMNH); Dr E. B. Britton (ANIC); Dr J. L. Gressitt (BPBM); Hugh B. Leech (CAS); Rhonda M. Stevens and Dr J. N. L. Stibick (DAPM); Dr B. Gray (DFB); Louise A. Bernard (FMNH); Dr L. Dieckmann (IP); Janice C. Scott (MCZ); Dr G. Scherer (MGF); Melle H. Perrin (MNHN); Rose E. Warner (NMNH); Helen Malcolm (NMV); J. Krikken (RNH); Dr E. G. Matthews (SAM); Dr R. Hertel (SMT); Dr S. Endrödi (TM).

I am especially grateful to Mrs P. Vaurie who searched for material at both AMNH and MNHN; to my colleague, Christine von Hayek, who investigated the collection of the Genoa Museum on my behalf and to my former colleague, Brian Levey, who discovered the Cape York specimens of *A. cornutus* in NMV. I also wish to thank Professor Vasco M. Tanner of Brigham Young University, Utah, for passing on to me 183 specimens from BPBM which he had intended to study himself.

The importance of accurate locality-data in the study of flightless insects cannot be over-emphasized (Thompson, 1968 : 360). In a mountainous country like New Guinea, altitude is also important. In this study, I was fortunate to have on loan material from the vast collection assembled at BPBM by Dr J. L. Gressitt; each specimen bears printed data-labels which include precise locality and altitude. Such material is a joy to work with and has formed the basis of this revision. Useful bionomic data were obtained from the extensive collection of DAPM and that of DFB.

A major contribution to this study was made by Dr R. W. Hornabrook, former Director, Papua New Guinea Institute of Medical Research, Goroka, whose enthusiastic collecting has produced several new species.

Help in tracing localities was given by Dr E. C. Zimmerman (ANIC), Dr J. J. H. Szent-Ivany (*ex*-DAPM), Dr J. N. L. Stibick (DAPM), Frau R. Kadlec (MGF) and Dr R. W. Hornabrook.

Information on parasites was provided by my colleagues, K. G. V. Smith (Diptera), Dr Z. Bouček (Commonwealth Institute of Entomology) (Hymenoptera) and J. MacFarlane (CIE) (Acarina). A pollen sample was identified by my colleague, Dr G. C. S. Clarke.

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The key was tested by Dr M. Cox (CIE) and by my assistant, Miss S. J. Reddick, who revealed several important weaknesses in the original draft. I wish to thank my senior colleague, R. D. Pope, for reading the manuscript and suggesting several significant improvements. I also thank Dr G. A. Samuelson for providing copies of the BPBM map of New Guinea and Dr F. J. Radovsky, Chairman, Department of Entomology, BPBM, for permission to reproduce them here.

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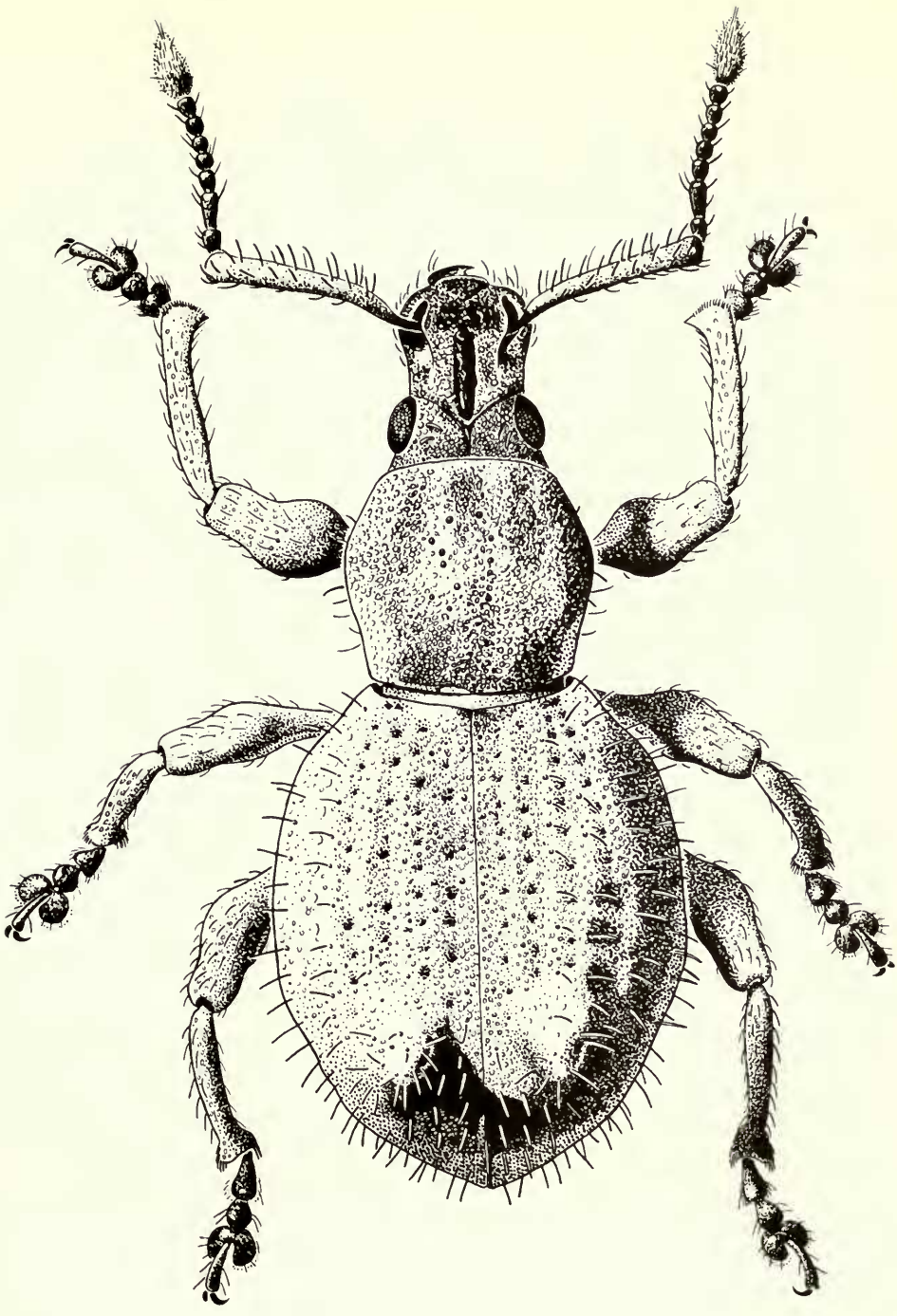
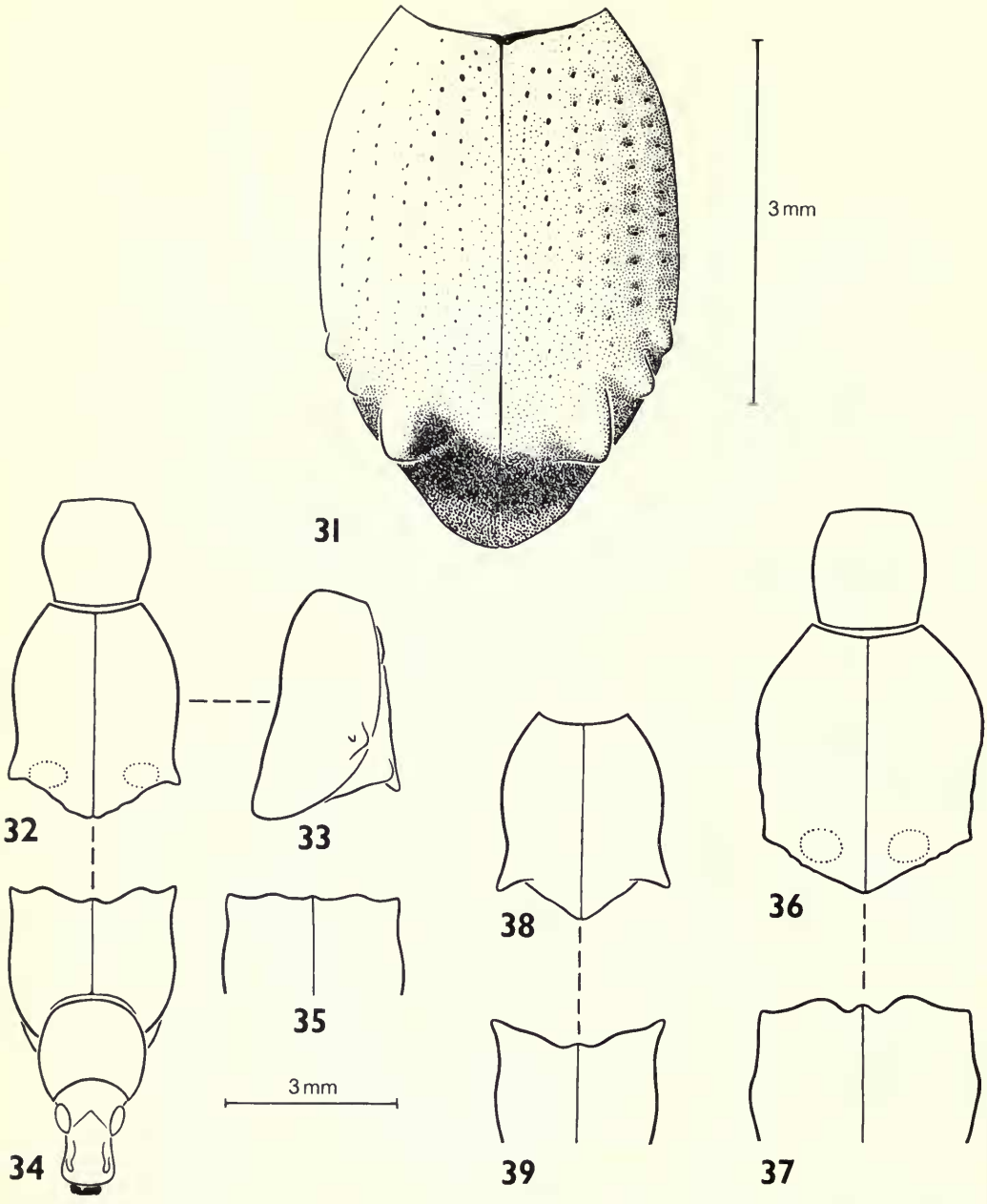
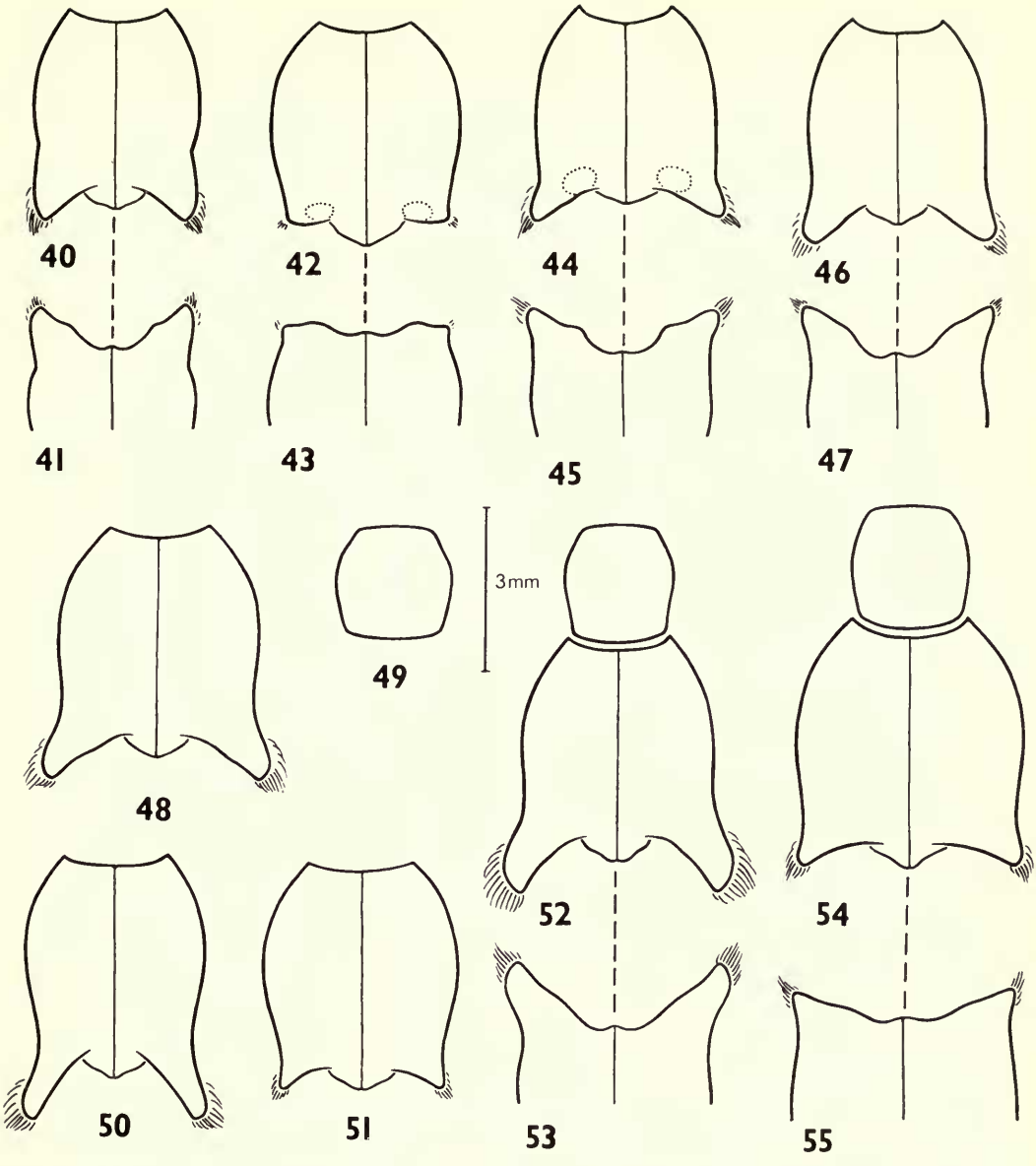


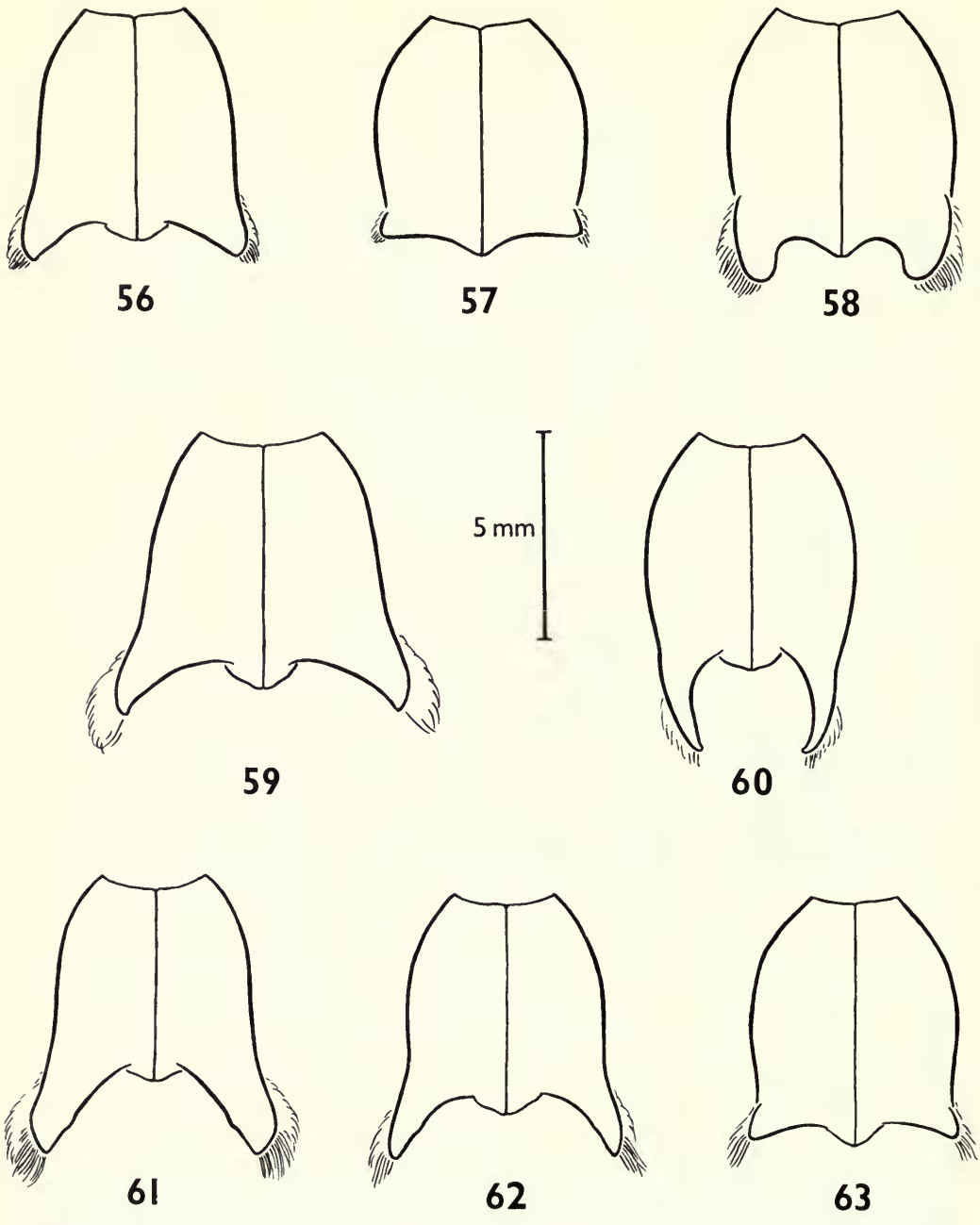
Fig. 30 *Apirocalus* (*Molobrium*) *io*.



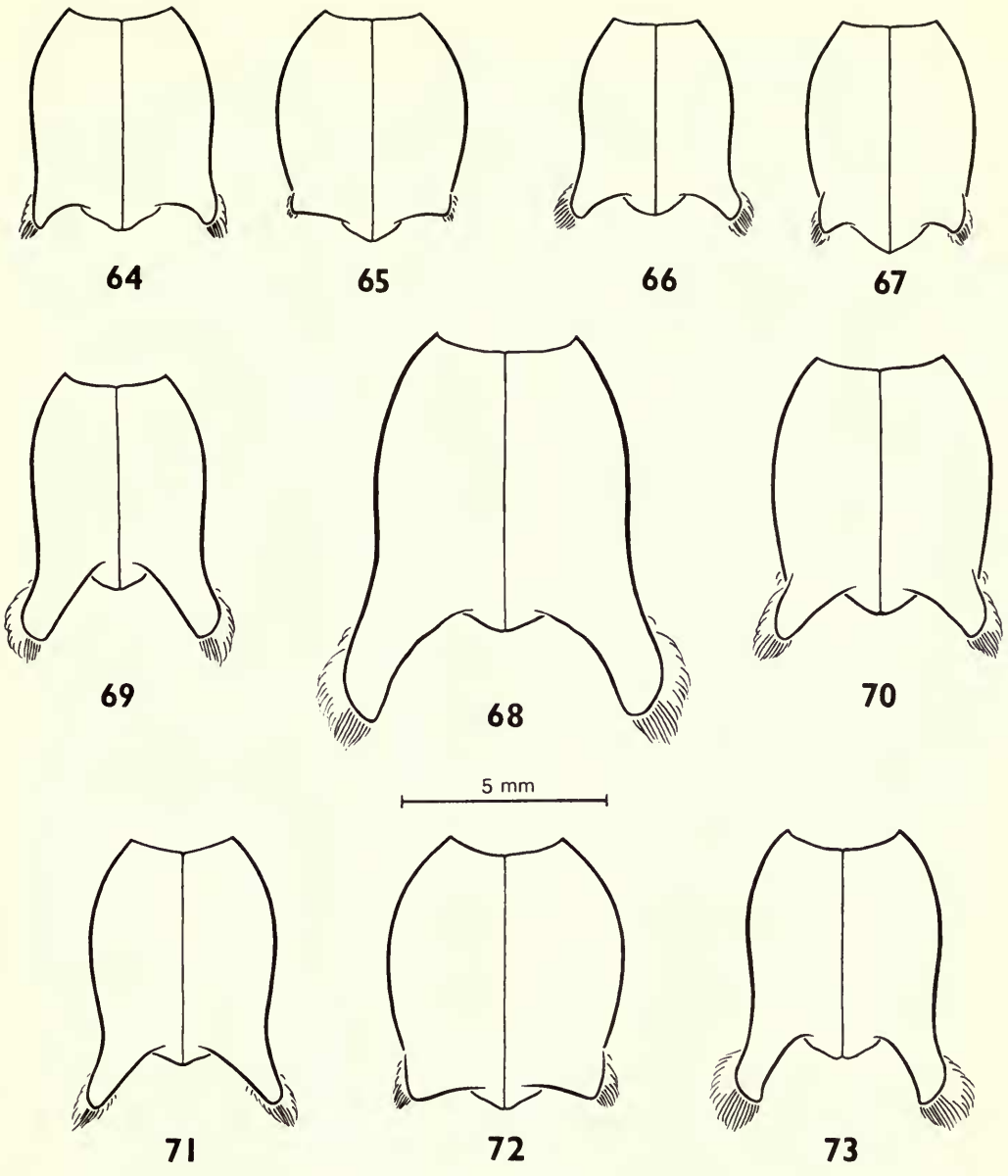
Figs 31–39 *Apirocalus* species. 31, elytra of *A.* (*Molobrium*) *stibicki* (vestiture omitted). 32–39, *A.* (*A.*) *fallax*-group, outlines. 32, *fallax* ♂ (holotype), prothorax and elytra in dorsal view; 33, *idem*, elytra in oblique left lateral view; 34, *idem*, body in antero-dorsal view, showing elytral swellings in profile; 35, *fallax* ♂ (Garaina), elytra in antero-dorsal view (cf. Fig. 34); 36, *fallax* ♀ (Bome), prothorax and elytra in dorsal view; 37, *idem*, elytra in antero-dorsal view; 38, *insperatus* ♂ (holotype), elytra in dorsal view; 39, *idem*, in antero-dorsal view.



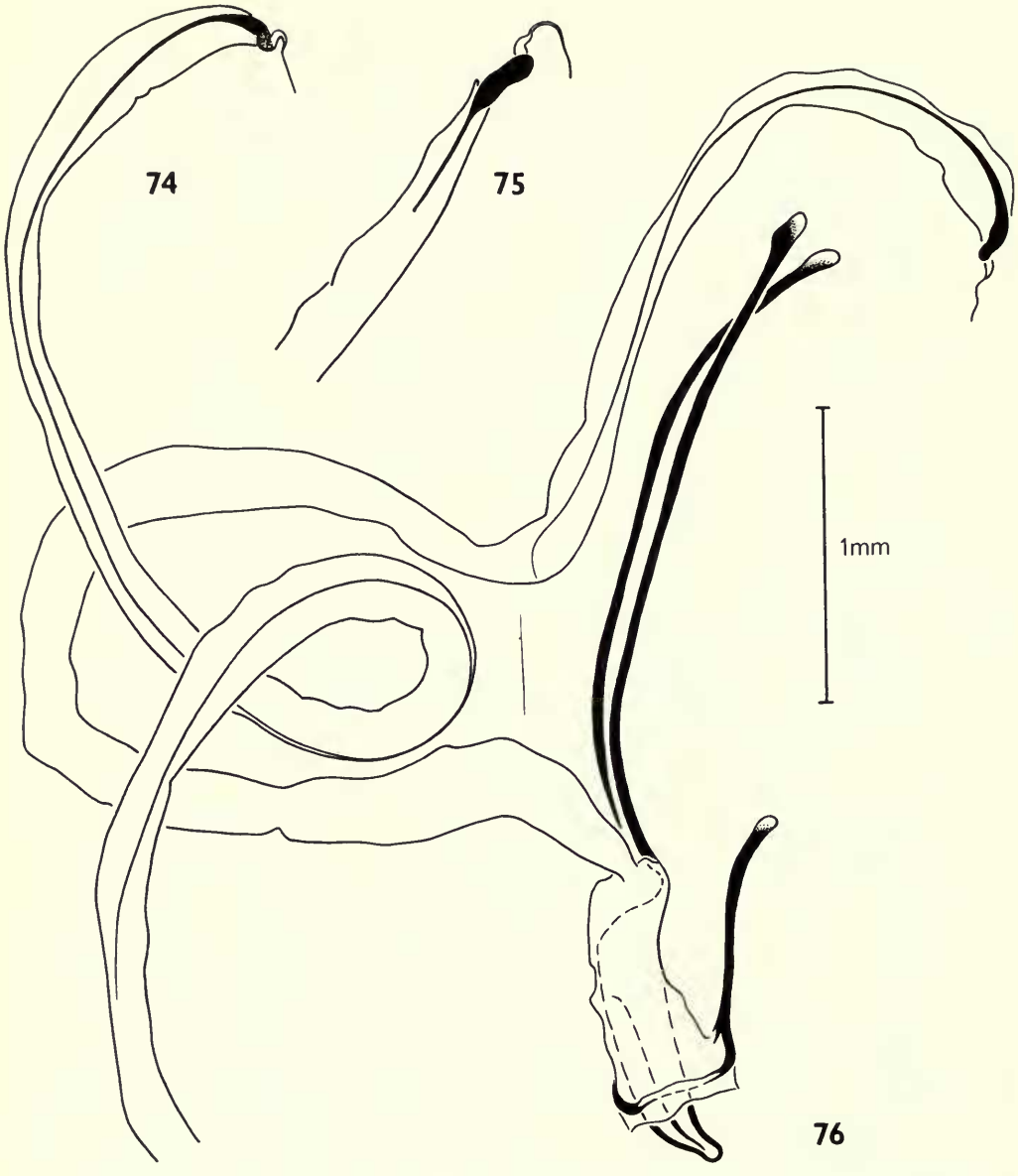
Figs 40–55 *Apirocalus* (*A.*) *avus*-group, outlines. Elytra in dorsal and antero-dorsal view (cf. Figs 32 and 34) of (40, 41) *subcostatus* ♂, (42, 43) *idem*, ♀, (44, 45) *suppuratus* ♂, (46, 47) *avus intermedius* ♂ (holotype). 48, elytra of *a. finisterrae* ♀ (Wantoat). 49, prothorax of *sedlaceki* ♂. 50, elytra of *a. marawakanus* ♂; 51, *idem*, ♀. 52, 53, prothorax and elytra in dorsal view and elytra in antero-dorsal view of *a. avus* ♂; 54, 55, *idem*, ♀.



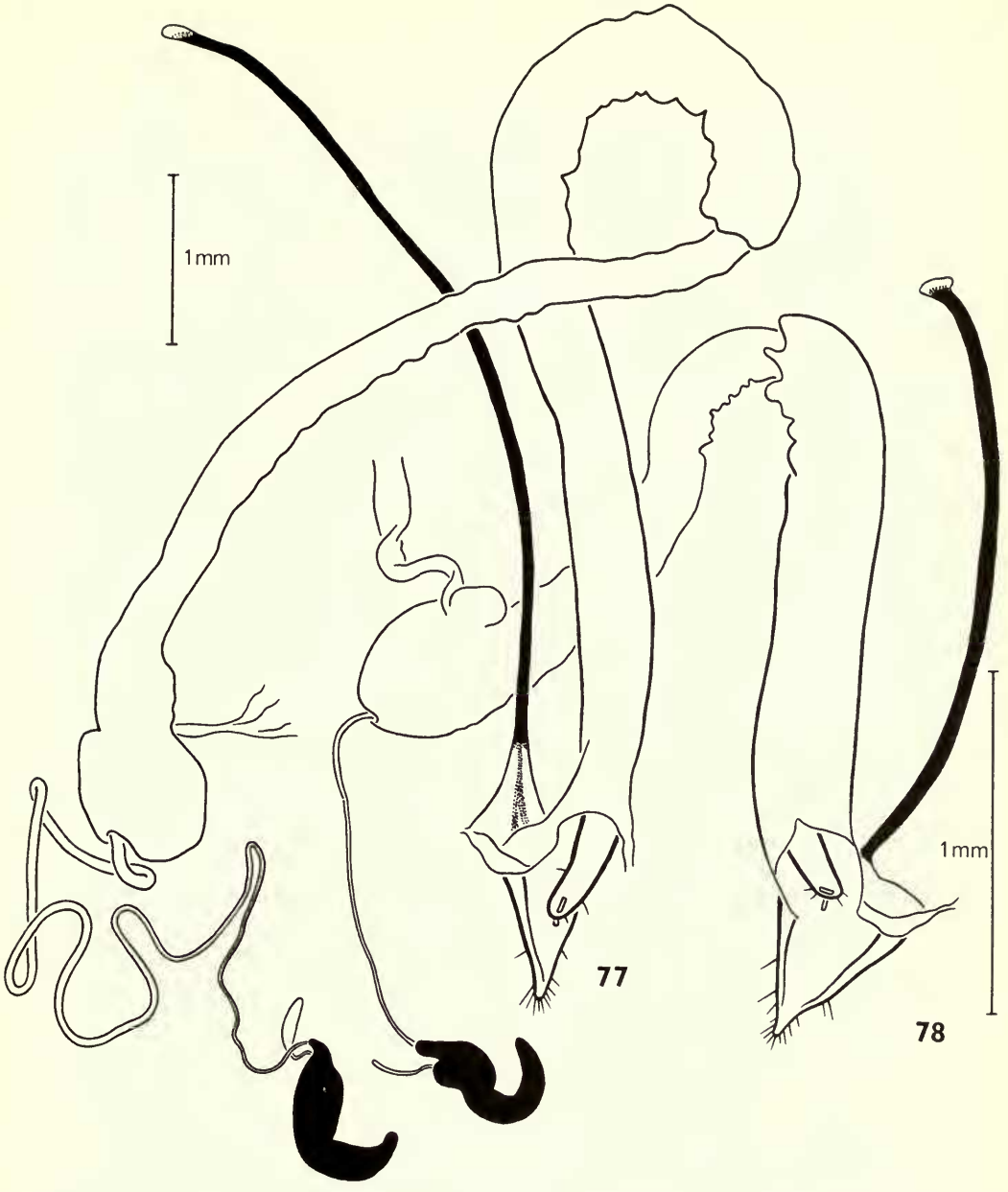
Figs 56–63 *Apirocalus* (*A.*) *cornutus*-group, outlines of elytra. 56, *c. cornutus* ♂ (Yule I.); 57, ***idem***, ♀; 58, *c. cornutus*, Brown River form ♀ (extreme example); 59, *paradoxus* ♂; 60, ***idem***, ♀; 61, *c. virescens* ♂ (Star Mts, 1245 m); 62, ***idem*** (Nomad, *c.* 300 m); 63, ***idem***, ♀ (Star Mts).



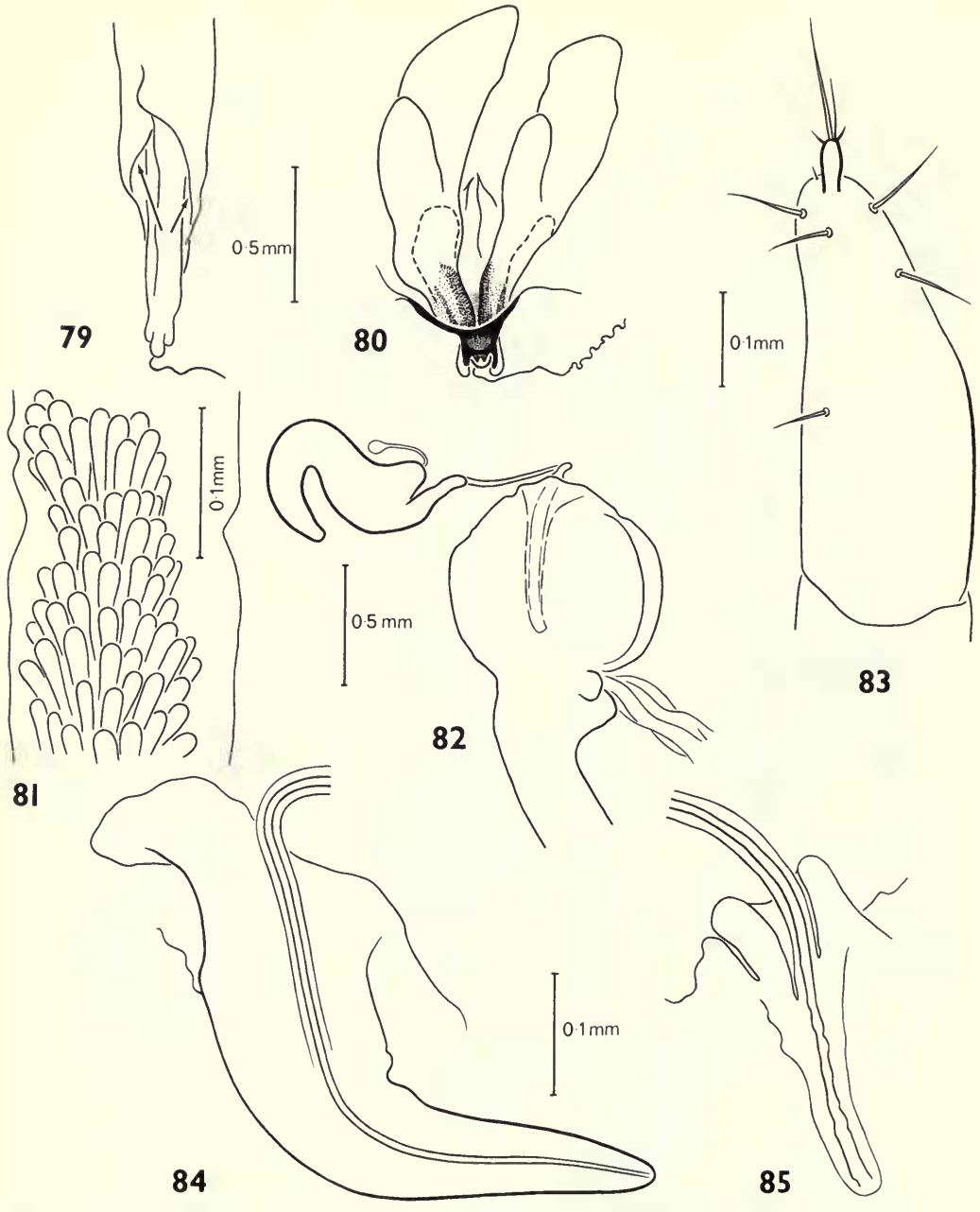
Figs 64–73 *Apirocalus* (*A.*) *cornutus*-group, outlines of elytra. 64, *e. ebrius*, lowland form ♂; 65, *idem*, ♀; 66, *mus* ♂; 67, *idem*, ♀; 68, *hornabrooki* ♂; 69, *ebrius angustus* ♂; 70, *idem*, ♀; 71, *ebrius wagneri* ♂; 72, *idem*, ♀; 73, *e. ebrius*, upland form ♂ (Kassam).



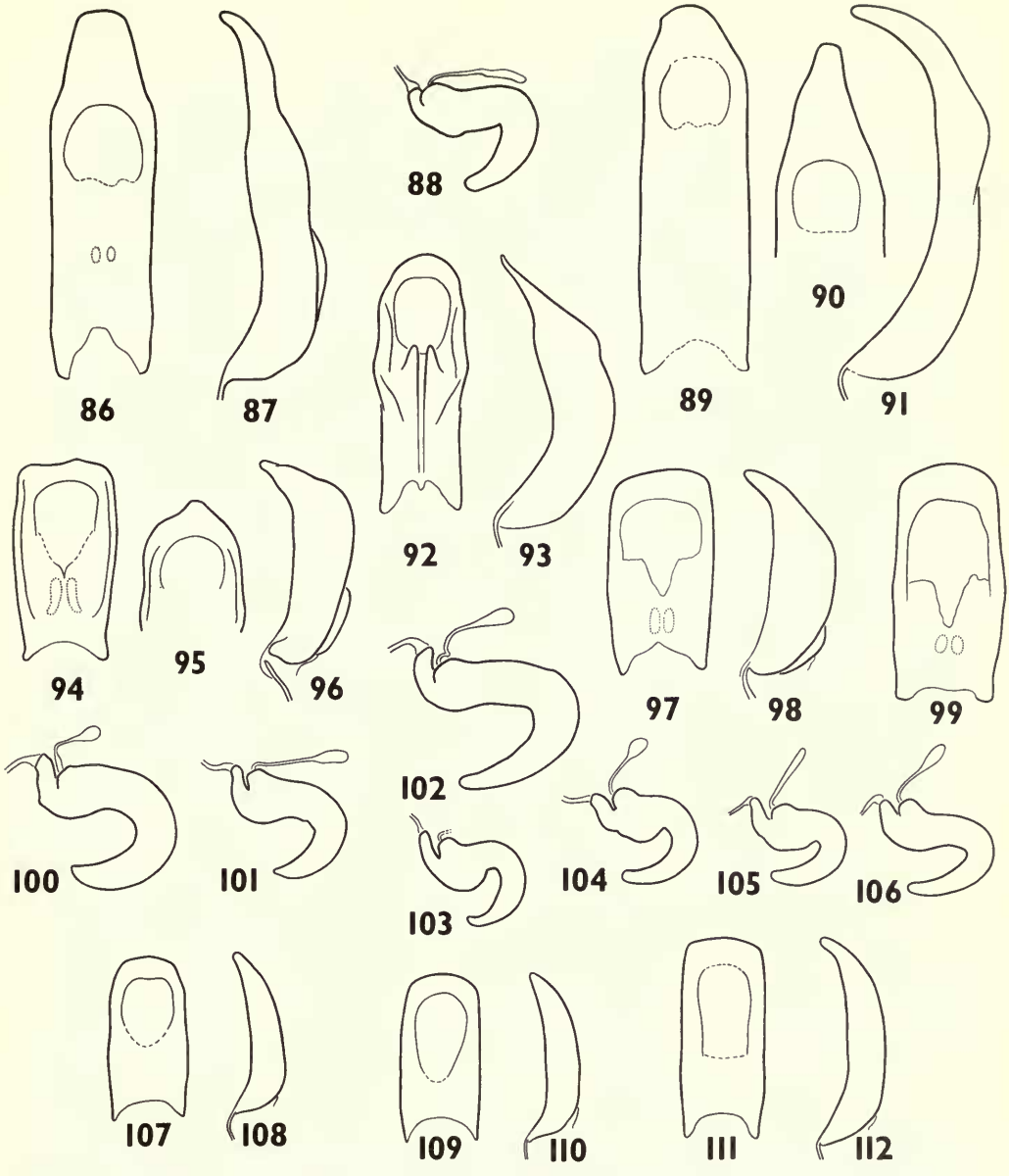
Figs 74–76 *Apirocalus* (*A.*) species, male genitalia. 74, internal sac of *ebrius* with long flagellum; 75, part of internal sac of *cornutus* with short flagellum; 76, genitalia of *avus karimuicus* with flagellum of intermediate length.



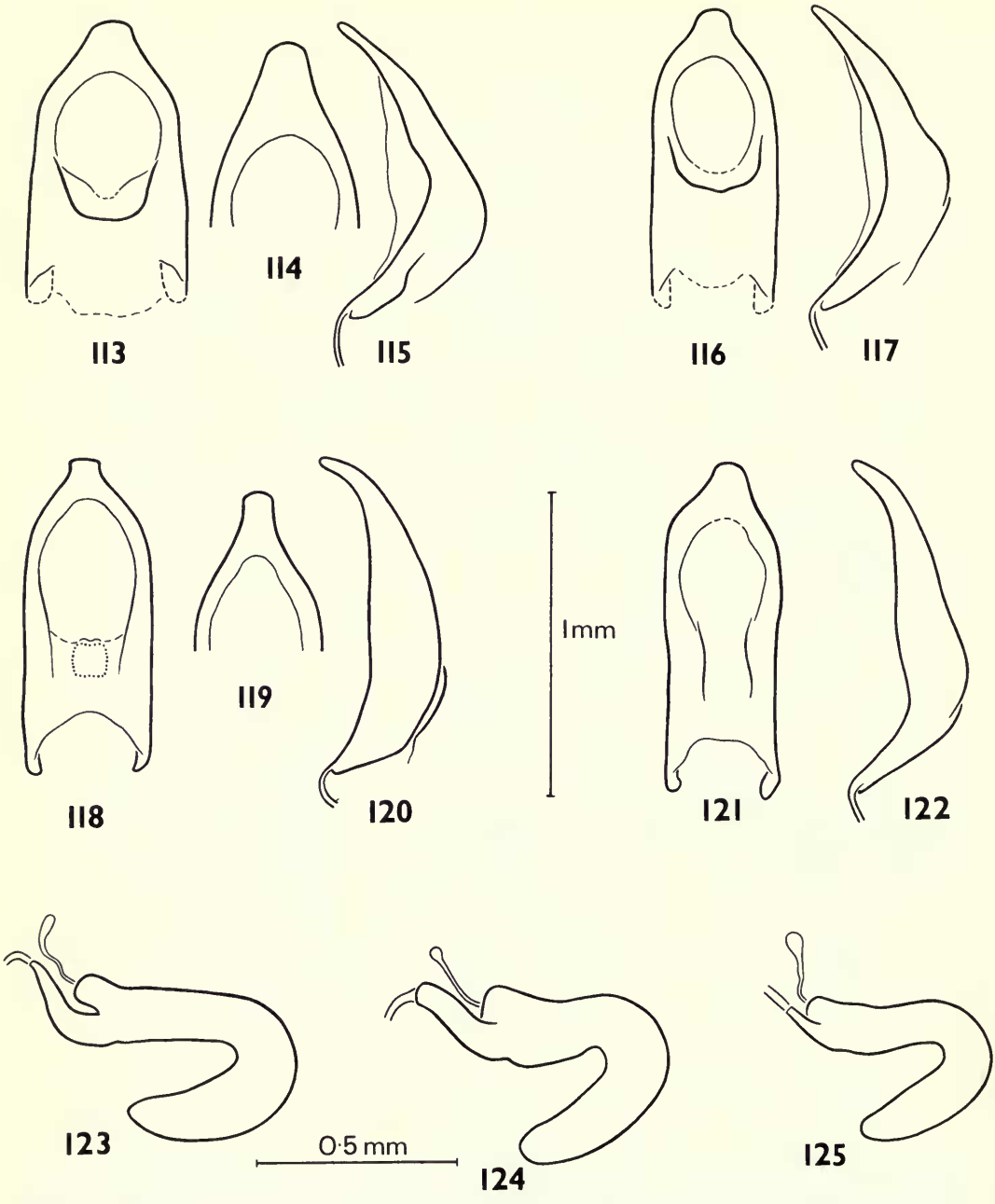
Figs 77, 78 *Apirocalus* species, female genitalia. 77, (*A.*) *bacchusi*; 78, (*Molobrium*) *t. terrestris*.



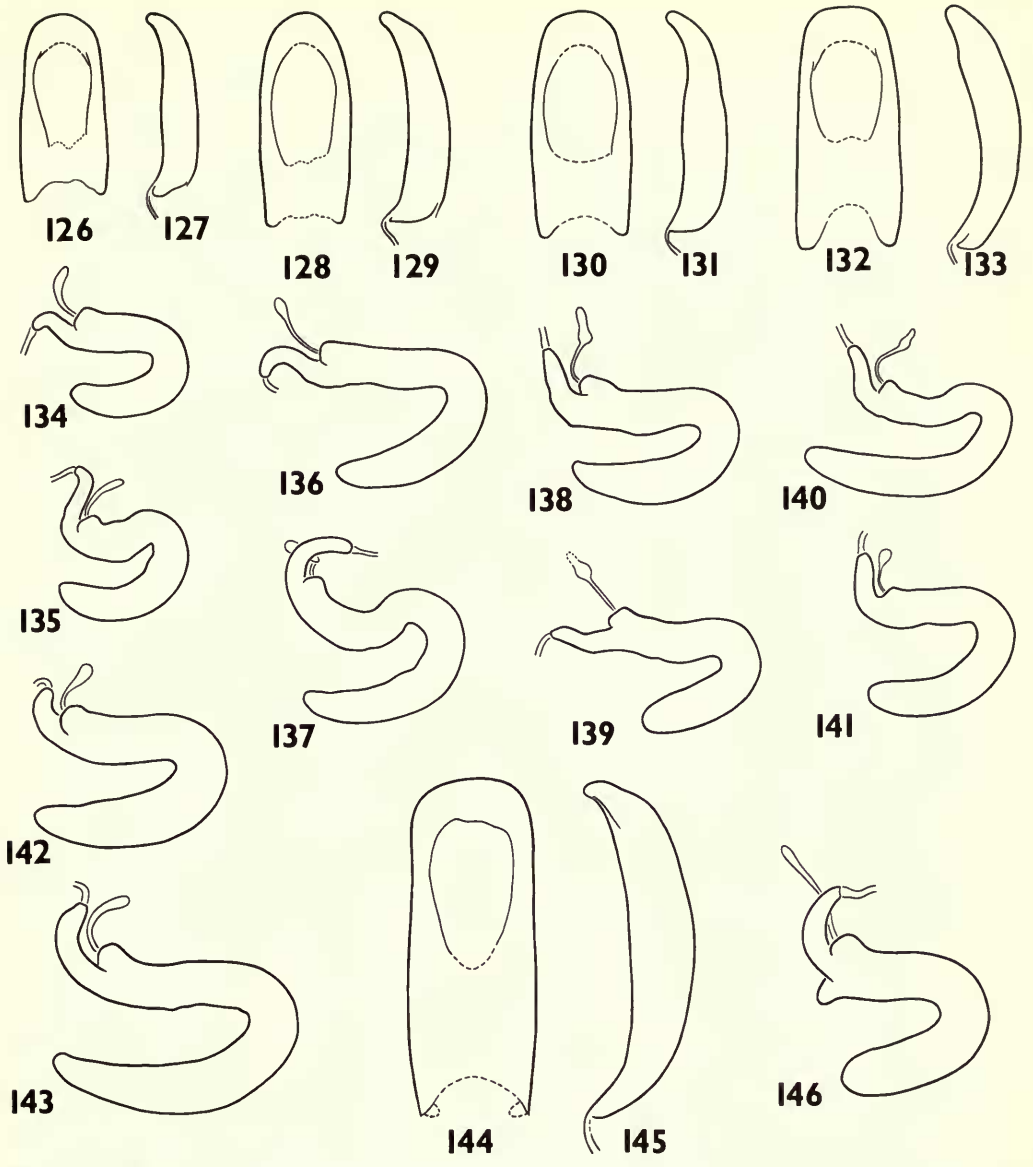
Figs 79–85 *Apirocalus* species, details of genitalia. 79, (*Molobrium*) *occultator*, anterior part of interior sac – arrows indicate openings of pouches; 80, *idem*, another specimen with pouches dissected out (note absence of flagellum); 81, (*A.*) *asper*, part of internal sac showing spatulate denticles; 82, (*A.*) *cornutus* ♀, with short spermathecal duct leading to spout in terminal chamber of bursa copulatrix; 83, (*A.*) *mus*, ovipositor valve; 84, (*M.*) *occultator*, spout; 85, (*M.*) *io*, spout.



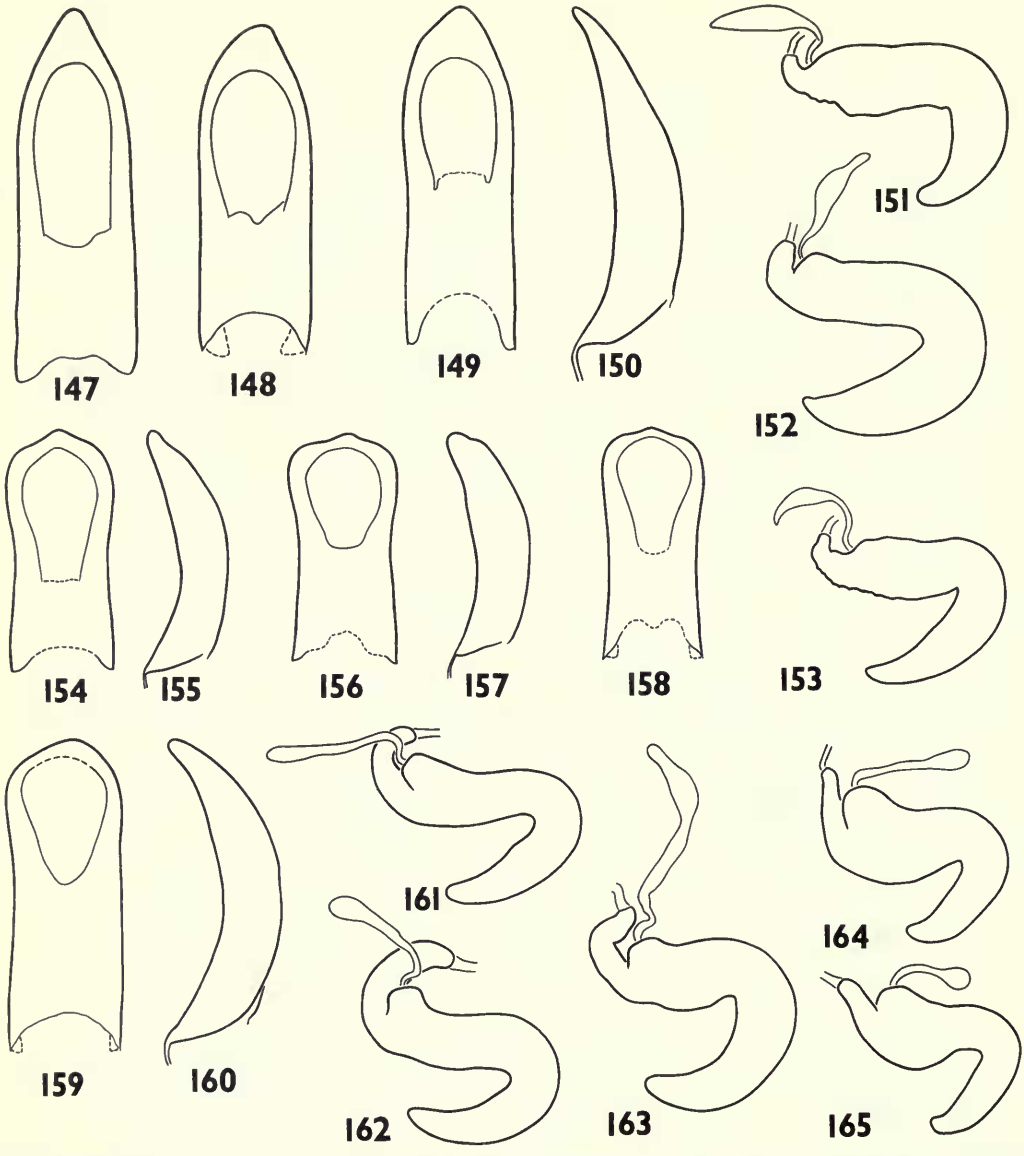
Figs 86–112 *Apirocalus* (*Molobrium*) species, genitalia. Aedeagus (in dorsal and right lateral view, sometimes also in postero-dorsal view to show true outline of apex) of (86, 87) *gracilis*, (89–91) *stibicki*, (92, 93) *io*, (94–96) *celatus*, (97–99) *occultator* (two specimens), (107–110) *t. terrestris* (two specimens), (111, 112) *terrestris dissidens*. Spermatheca of (88) *gracilis*, (100, 101) *celatus*, (102) *occultator*, (103, 104) *io*, (105) *t. terrestris*, (106) *terrestris dissidens*. (Scales as for Figs 207–217.)



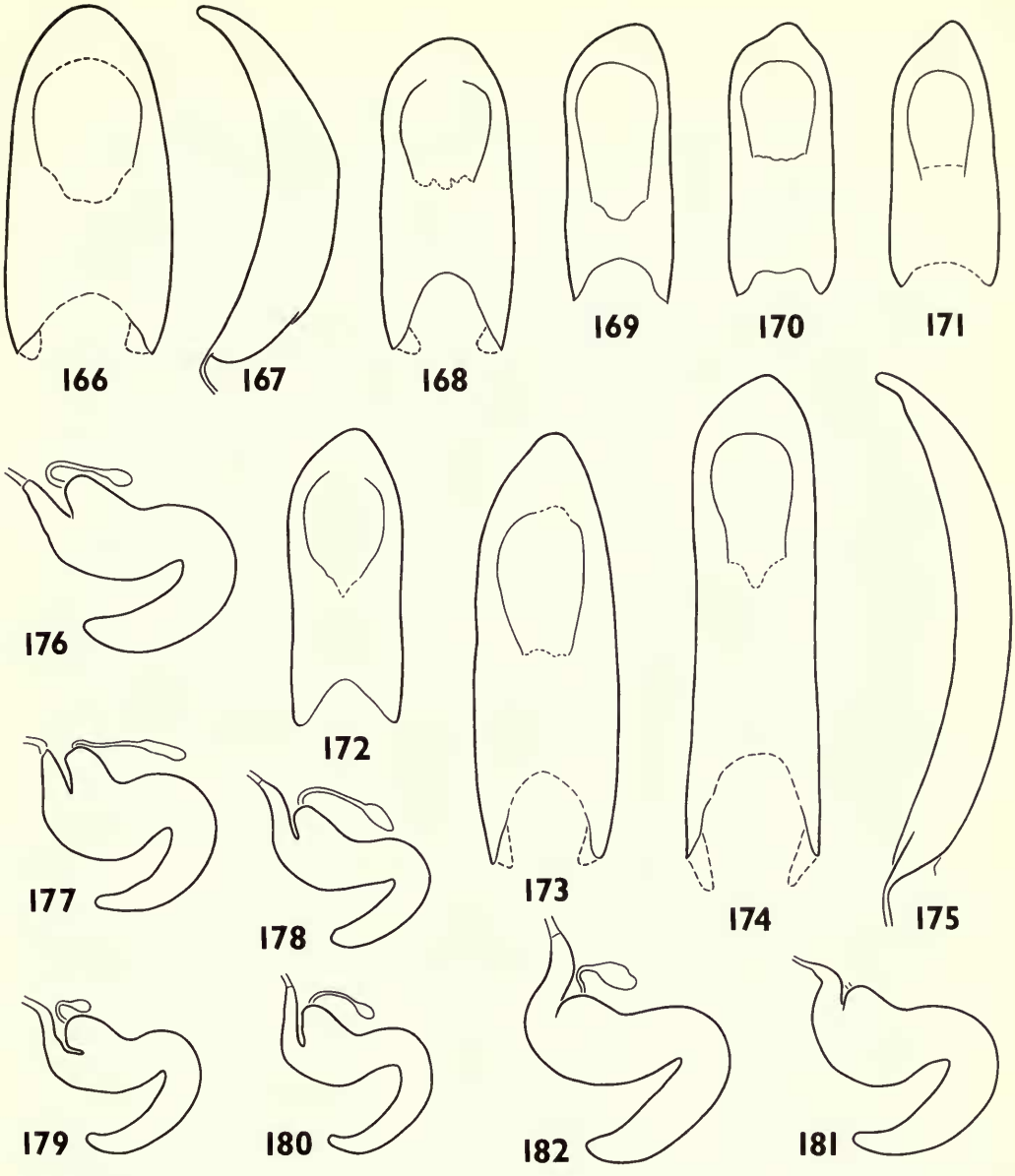
Figs 113–125 *Apirocalus* (*A.*) *fallax*-group, genitalia. Aedeagus (views as in Figs 86, etc.) of (113–115) *fallax* (Mt Missim), (116, 117) *idem* (Metsialavava), (118–120), *insperatus*, (121, 122) *asper*. 123–125, spermathecae of *fallax*.



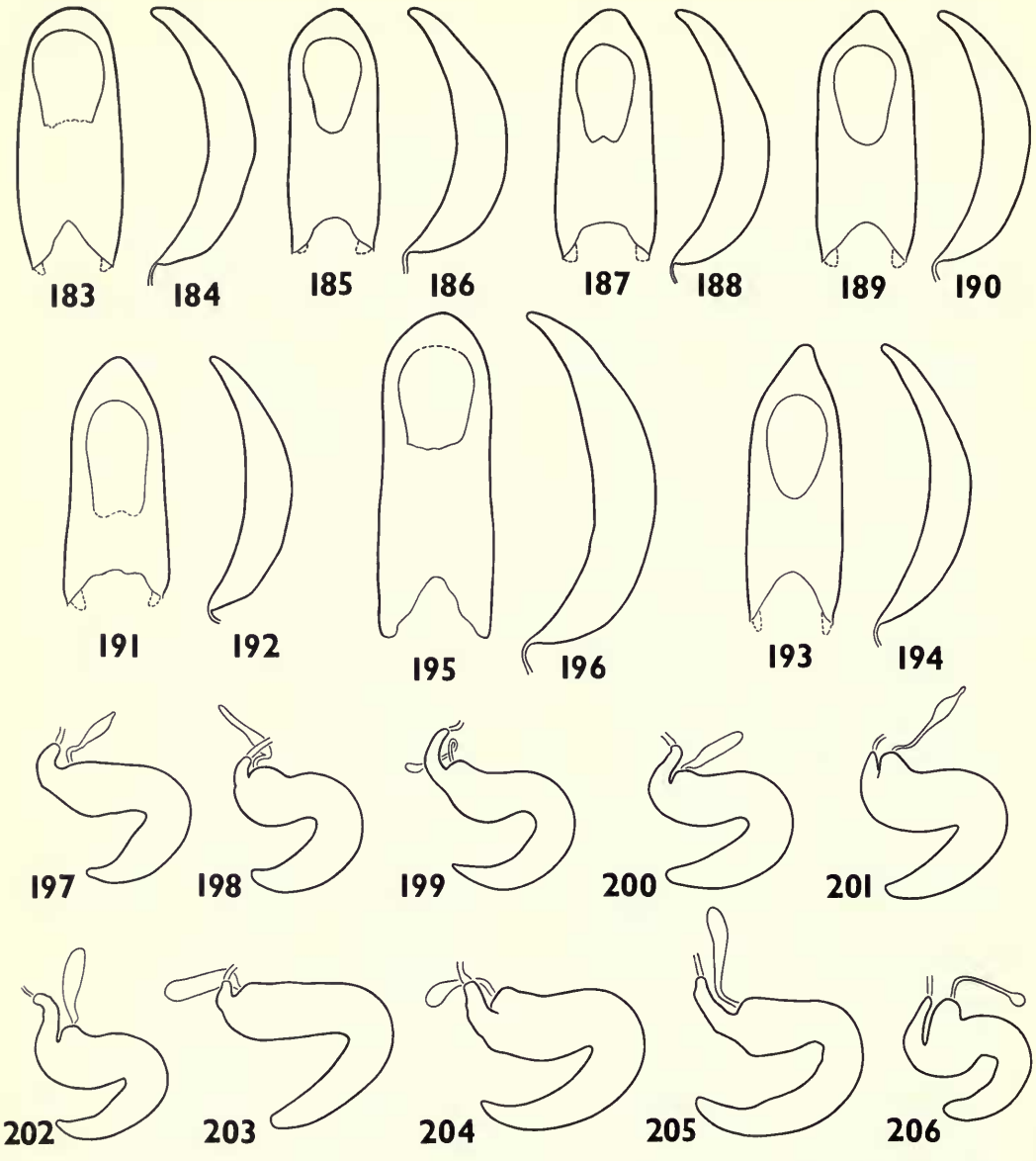
Figs 126–146 *Apirocalus* (*A.*) species, genitalia. 126–143, *avus*-group. Aedeagus, in dorsal and right lateral view, of (126, 127) *subcostatus*, (128, 129) *a. avus*, (130, 131) *avus intermedius*, (132, 133) *sedlaceki*. Spermatheca of (134, 135) *subcostatus*, (136, 137) *a. avus*, (138, 139) *avus intermedius*, (140, 141) *sedlaceki*, (142) *suppuratus*, (143) *canus*. 144–146, *granulicollis*. 144, 145, aedeagus. 146, spermatheca. (Scales as for Figs 207–217.)



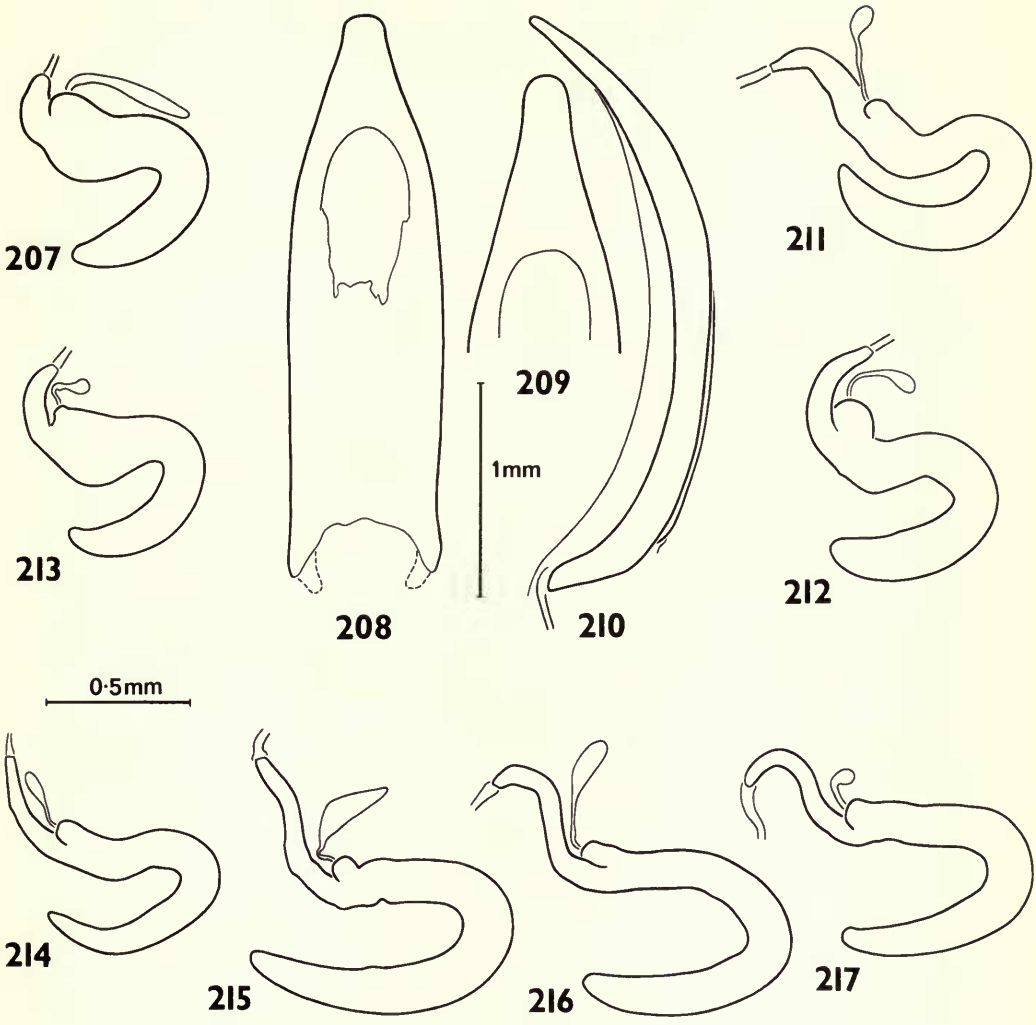
Figs 147–165 *Apirocalus* (*A.*) species, genitalia. 147–153, *nivosus*-group. Aedeagus of (147) *nivosus*, (148) *atrigenua*, (149, 150) *bacchusi*. Spermatheca of (151) *bacchusi*, (152) *atrigenua*, (153) *nivosus*. 154–165, *hydrographicus*-group. Aedeagus of (154–157) *hydrographicus* (two specimens), (158) *orientalis*, (159, 160) *vexillarius*. Spermatheca of (161, 162) *hydrographicus*, (163) *ater*, (164, 165) *vexillarius*. (Scales as for Figs 207–217.)



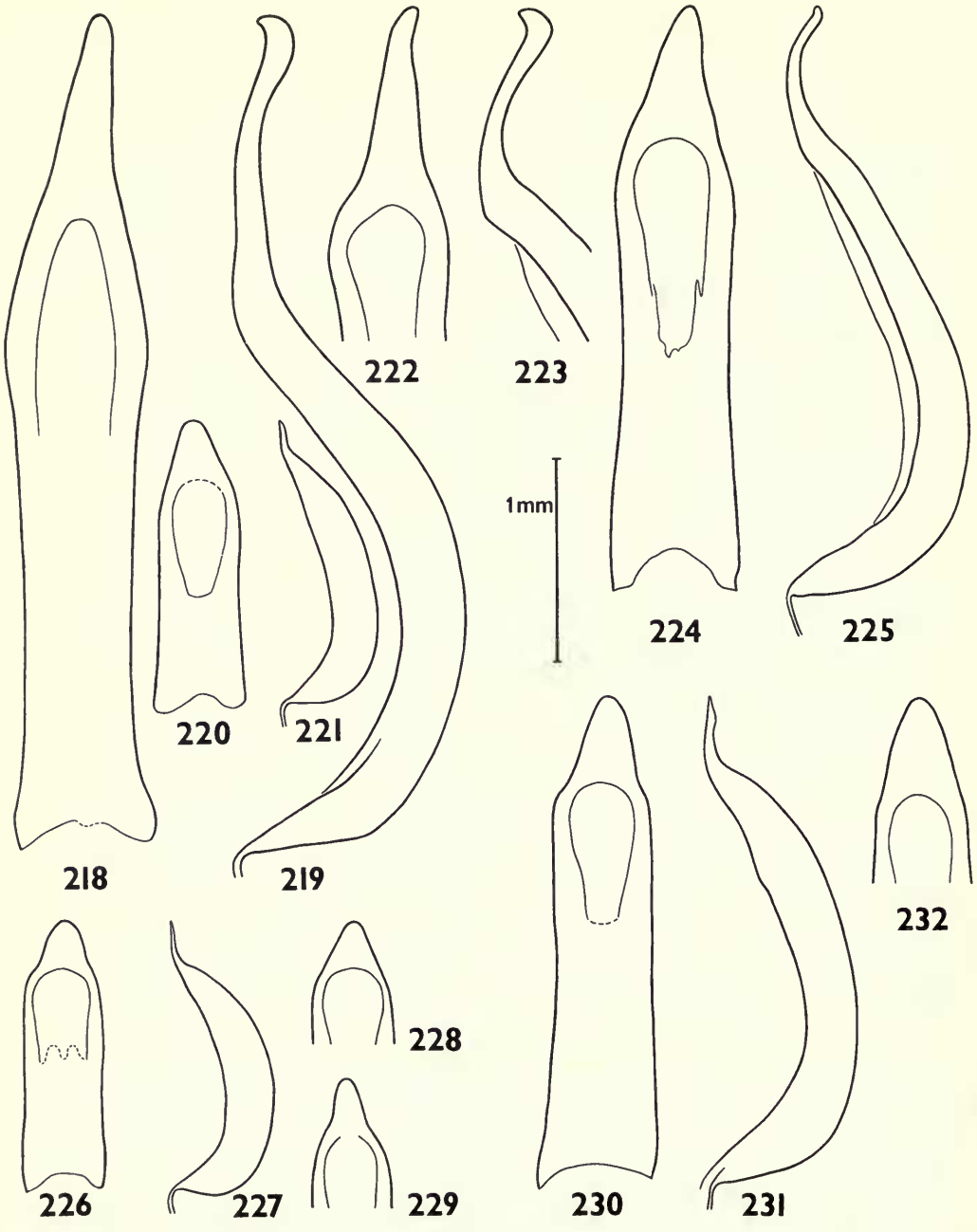
Figs 166–182 *Apirocalus* (*A.*) *cornutus*-group, genitalia. Aedeagus of (166, 167) *c. cornutus* (Yule I.), (168) *idem* (Brown River), (169) *idem* (Murray I.), (170) *c. tenuiscapus* (Mafulu), (171) *idem* (Loloipa), (172) *c. virescens* (Star Mts), (173) *idem* (Lake Kutubu), (174, 175) *paradoxus*. Spermathecae of (176, 177) *c. cornutus*, (178–180) *c. tenuiscapus*, (181) *c. virescens*, (182) *paradoxus*. (Scales as for Figs 207–217.)



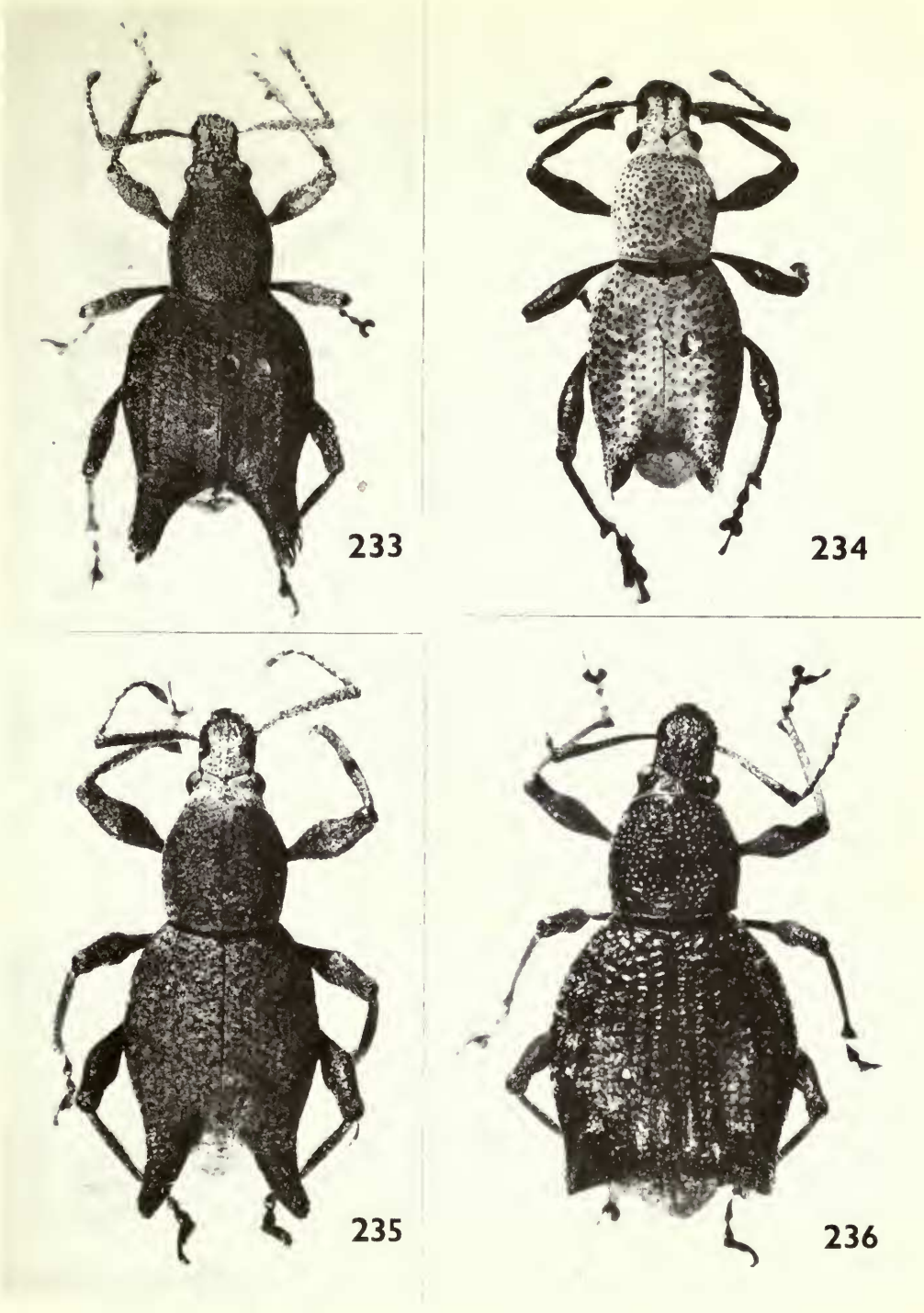
Figs **183–206** *Apirocalus* (*A.*) *cornutus*-group, genitalia. Aedeagus in dorsal and right lateral view of (183, 184) *mus*, (185–188) *e. ebrius*, lowland form (two specimens), (189, 190) *idem*, upland form (Wau), (191, 192) *e. angustus*, (193, 194) *e. wagneri*, (195, 196) *hornabrooki*. Spermatheca of (197–199) *e. ebrius*, lowland form, (200, 201) *idem*, upland form (Wau), (202) *e. angustus*, (203, 204) *e. wagneri*, (205) *hornabrooki*, (206) *mus*. (Scales as for Figs 207–217.)



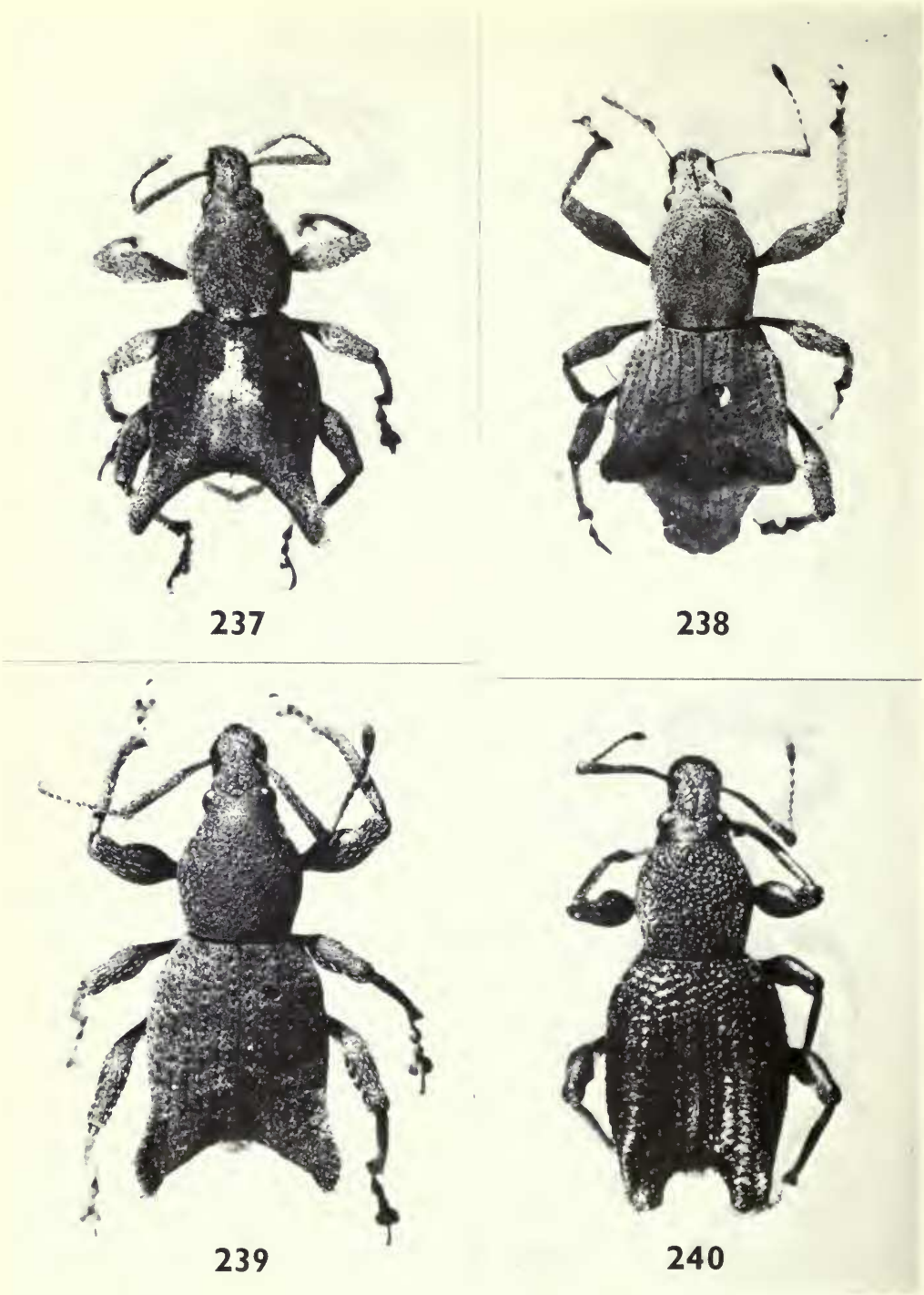
Figs 207–217 *Apirocalus* (*A.*) species, genitalia. 207, *acutus*, spermatheca. 208–210, *idem* (holotype), aedeagus in dorsal, postero-dorsal and right lateral view. 211, 212, *strigifrons*, spermathecae. 213–217, *olivaceus*-group, spermathecae. 213, *stellifer*; 214, *olivaceus* (Lake Sirunki); 215, 216, *idem* (Marifuanga); 217, *tenebricosus*.



Figs 218–232 *Apirocalus* (*A.*) *olivaceus*-group, aedeagi in dorsal and right lateral view. 218, 219, *anatinus*; 220, 221, *stellifer*; 222–225, *tenebricosus* (two specimens); 226–229, *olivaceus*, small form (three specimens); 230–232, *idem*, normal form (two specimens).



Figs 233–236 *Apirocalus* (*A.*) species. 233, *strigifrons* ♀; 234, *nivosus* ♂; 235, *atrigenua* ♂; 236, *atrigenua* ♀ (abraded).



Figs 237–240 *Apirocalus* (*A.*) species. 237, *stellifer* ♂; 238, *anatinus* ♂ (holotype); 239, *granulicollis* ♂; 240, *granulicollis* ♀ (abraded).

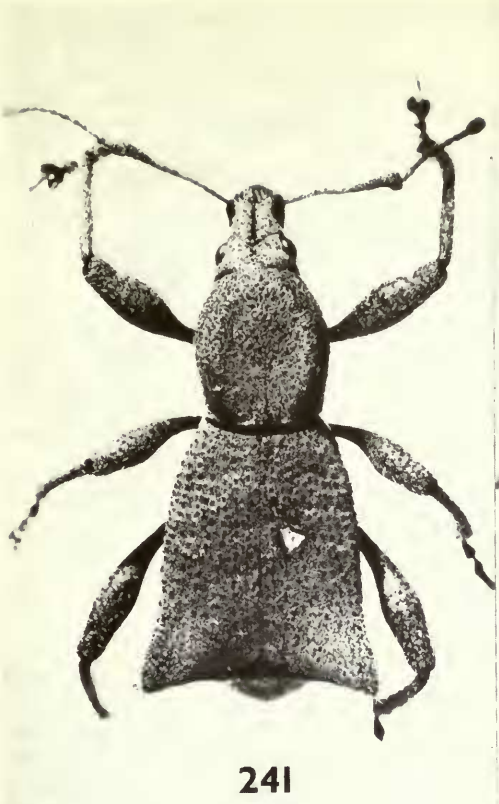
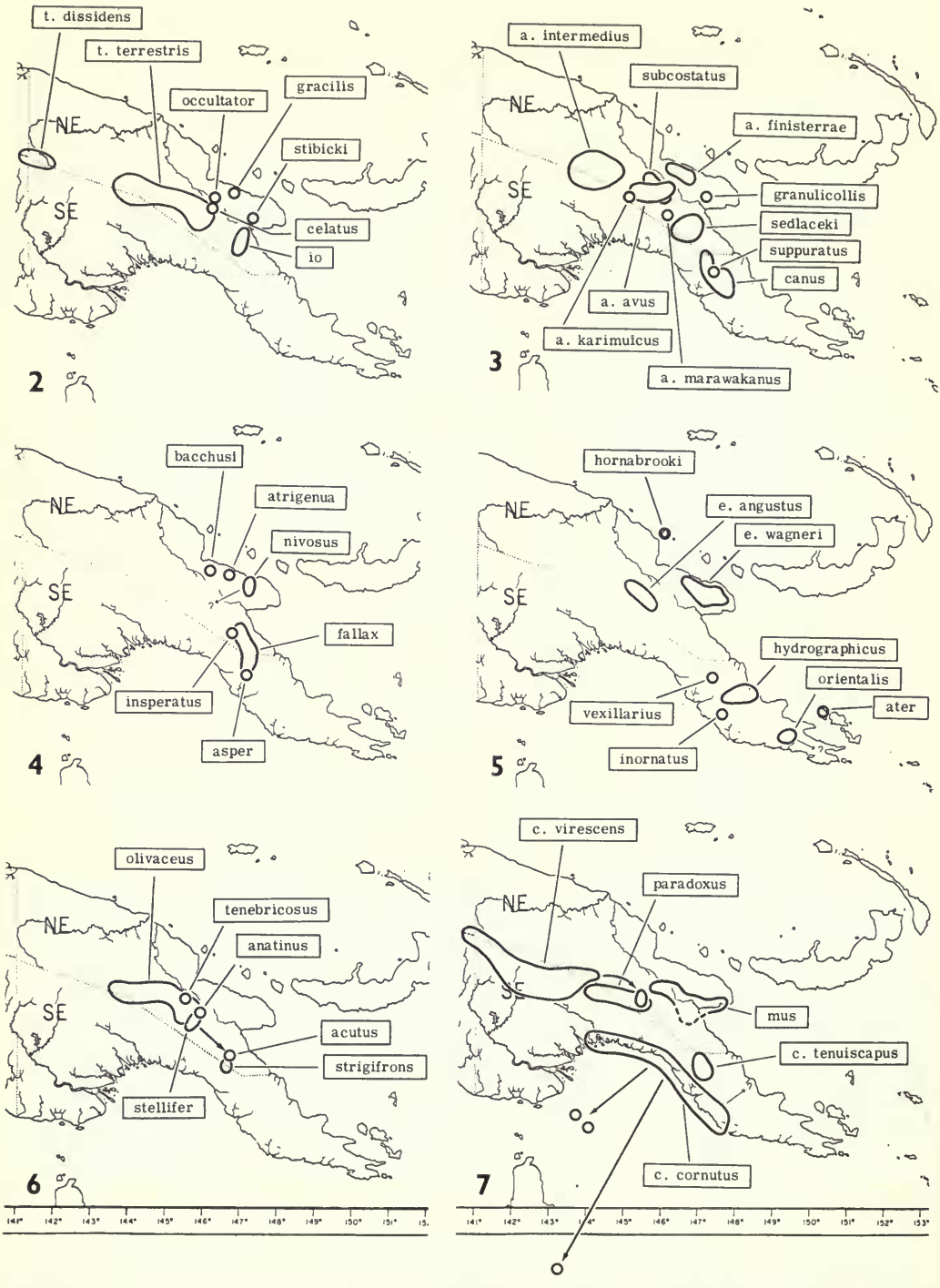


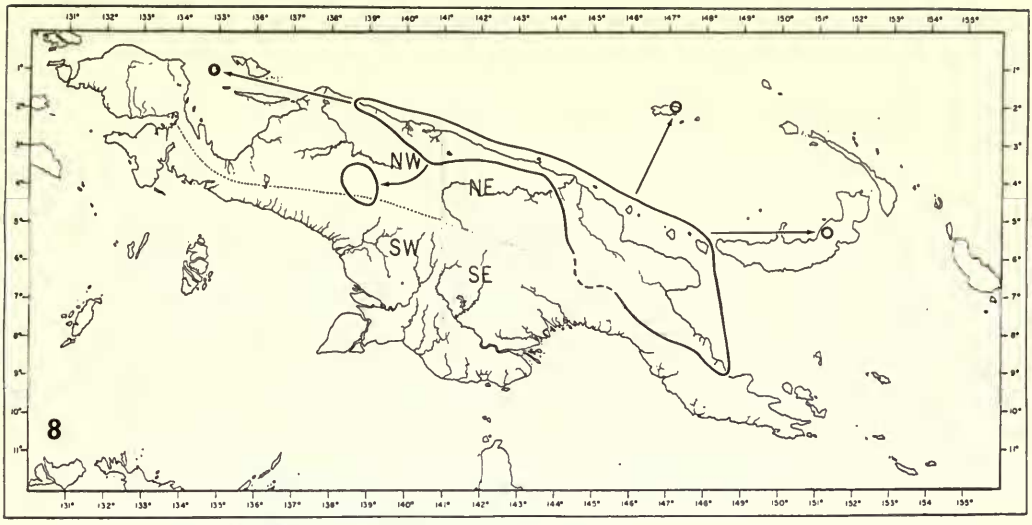
Fig. 241 *Apirocalus* (*A.*) *acutus* ♂ (holotype).

Fig. 242 *Albertisius gestroi* ♂.

Figs 243–245 *Apirocalus* (*A.*) species. 243, *cornutus* ♀, thorax in side view, showing large setae on postero-ventral margin of prothorax (arrowed); 244, *cornutus* ♀, head and rostrum in dorsal view (rim of pterygium arrowed); 245, *sedlaceki*, thorax in side view, showing pale fleck on arm of mesosternum (arrowed).



Maps 2–7 Ranges of *Apirocalus* species. 2, subgenus *Molobrium*; 3, *avus*-group and *granulicollis*; 4, *fallax*-group and *nivosus*-group; 5, *hydrographicus*-group and *cornutus*-group (part); 6, *olivaceus*-group, *acutus* and *strigifrons*; 7, *cornutus*-group (part).



Map 8 Range of *Apirocalus e. ebrius* (*cornutus*-group).

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